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NORTH AMERICAN FAUNA

No. 44

[Actual date of publication, June 13, 1918]

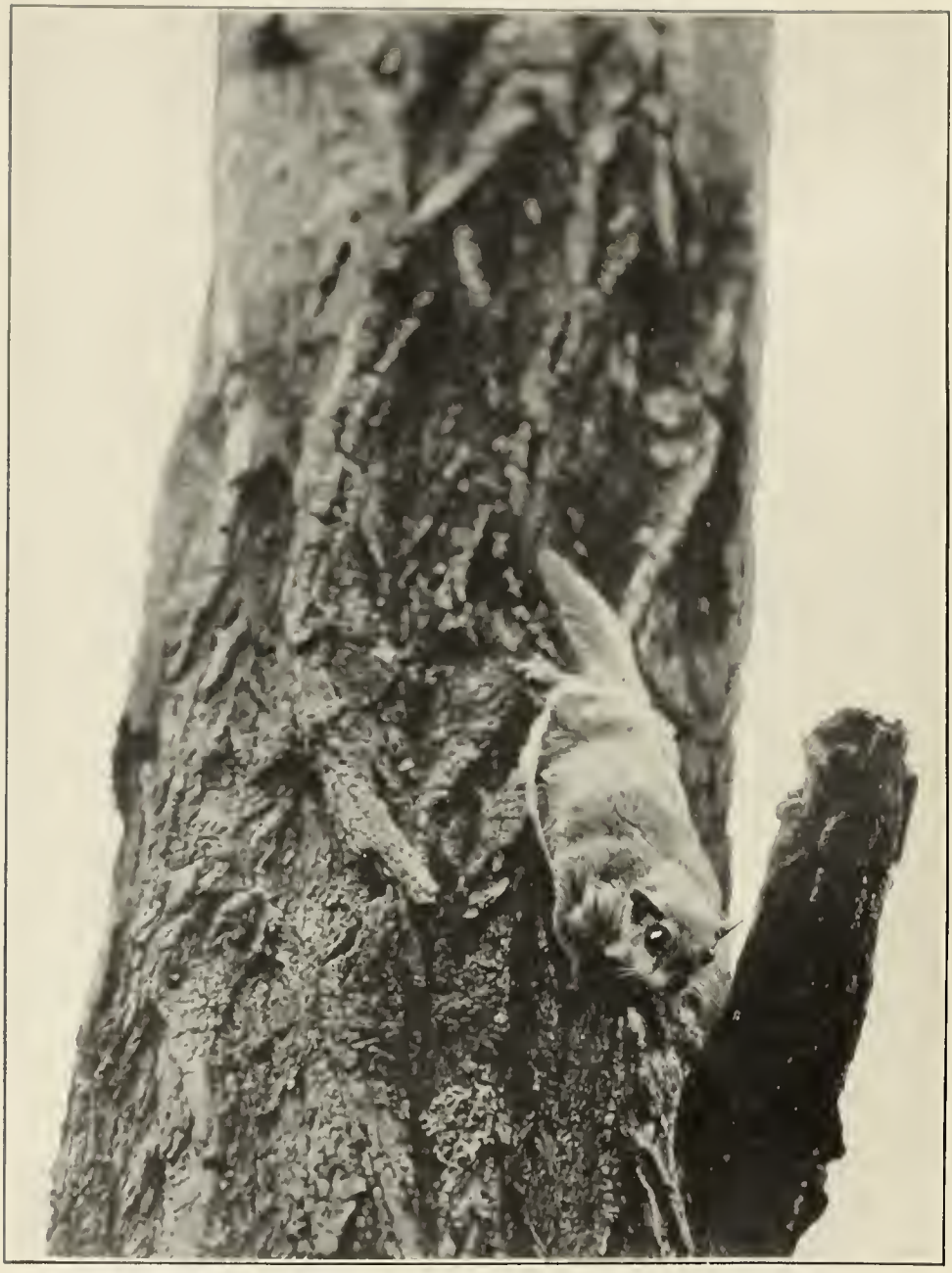
REVISION OF THE AMERICAN FLYING SQUIRRELS

BY

ARTHUR H. HOWELL

ASSISTANT BIOLOGIST, BIOLOGICAL SURVEY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1918



B634M

SMALL EASTERN FLYING SQUIRREL (GLAUCOMYS VOLANS VOLANS).

From life; Coram, N. Y., August, 1915; photographed by Francis Harper.

U. S. DEPARTMENT OF AGRICULTURE
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LETTER OF TRANSMITTAL.

United States Department of Agriculture,
Bureau of Biological Survey,
Washington, D. C., March 9, 1917.

Sir: I have the honor to transmit for publication as North American Fauna No. 44 a revision of the American flying squirrels (genus *Glaucomys*), by Arthur H. Howell, assistant biologist of this bureau. The revision is based largely upon material in the collection of the Biological Survey. Flying squirrels are found over much of North America, and this report on the group gives needed information concerning the number of forms and their distribution.

Respectfully,

E. W. Nelson,
Chief Biological Survey.

Hon. David F. Houston,
Secretary of Agriculture.

CONTENTS.

	Page.
Introduction	5
Habits	5
Voice	6
Nests	7
Breeding	8
Food	9
Economic status	10
Pelage and molt	10
Explanation of cranial measurements	11
Material examined	11
Genus *Glaucomys*	11
History and nomenclature	12
Generic names	12
Specific names	13
Generic characters	14
List of species and subspecies, with type localities	16
Key to species and subspecies	16
Descriptions of species and subspecies	18
Glaucomys volans group	18
Glaucomys sabrinus group	29
Tables of cranial measurements	59
Explanation of plates	62
Index	63

ILLUSTRATIONS.

PLATES.

[Plate I, frontispiece; Plates II–VII, following page 62.]

PLATE I. Small eastern flying squirrel (*Glaucomys volans volans*).

II. Skulls (dorsal view) of *Glaucomys volans saturatus*, *G. v. volans*, *G. v. texensis*, *G. v. goldmani*, *G. v. querceti*, *G. sabrinus bangsi*, *G. s. alpinus*, *G. s. canescens*, *G. s. yukonensis*, *G. s. macrotis*, *G. s. sabrinus*, and *G. s. makkovikensis*.

III. Skulls (dorsal view) of *Glaucomys sabrinus stephensi*, *G. s. flaviventris*, *G. s. klamathensis*, *G. s. fuliginosus*, *G. s. lascivus*, *G. s. zaphæus*, *G. s. columbiensis*, *G. s. latipes*, *G. s. californicus*, *G. s. olympicus*, *G. s. oregonensis*, and *G. s. bullatus*.

IV. Skulls (ventral view) of *Glaucomys volans saturatus*, *G. v. volans*, *G. v. texensis*, *G. v. goldmani*, *G. v. querceti*, *G. sabrinus bangsi*, *G. s. alpinus*, *G. s. canescens*, *G. s. yukonensis*, *G. s. macrotis*, *G. s. sabrinus*, and *G. s. makkovikensis*.

V. Skulls (ventral view) of *Glaucomys sabrinus stephensi*, *G. s. flaviventris*, *G. s. klamathensis*, *G. s. fuliginosus*, *G. s. lascivus*, *G. s. zaphæus*, *G. s. columbiensis*, *G. s. latipes*, *G. s. californicus*, *G. s. olympicus*, *G. s. oregonensis*, and *G. s. bullatus*.

VI. Skulls (lateral view) of *Glaucomys volans volans*, *G. v. querceti*, *G. v. saturatus*, *G. v. texensis*, *G. sabrinus macrotis*, *G. s. sabrinus*, *G. s. columbiensis*, *G. s. oregonensis*, *G. s. zaphæus*, *G. s. bangsi*, *G. s. canescens*, and *G. s. alpinus*.

VII. Skulls (lateral view) of *Glaucomys sabrinus lascivus*, *G. s. flaviventris*, *G. s. klamathensis*, *G. s. bullatus*, *G. s. californicus*, *G. s. olympicus*, *G. s. fuliginosus*, *G. s. latipes*, and *G. s. stephensi;* mandible of *G. s. sabrinus;* and skull (mandible and dorsal, ventral, and lateral views) of *Pteromys büchneri*.

TEXT FIGURES.

		Page.
FIG. 1.	Map showing distribution of *Glaucomys sabrinus* and *G. volans*	6
2.	Map showing distribution of the subspecies of *Glaucomys volans*	19
3.	Map showing distribution of the subspecies of *Glaucomys sabrinus* except *G. s. bullatus*	30
4.	Map showing distribution of *Glaucomys sabrinus bullatus*	51

No. 44. NORTH AMERICAN FAUNA. June 13, 1918.

REVISION OF THE AMERICAN FLYING SQUIRRELS.

By Arthur H. Howell.

INTRODUCTION.

The American flying squirrels comprise two distinct groups—the small species (*Glaucomys volans*) of eastern United States and Mexico; and the larger species (*G. sabrinus*) occupying western United States and Canada, with one form ranging into New England and the border States along the Great Lakes (fig. 1).

HABITS.

Flying squirrels are almost exclusively arboreal, seldom descending to the ground and apparently never running for any distance on its surface. They are unsuspicious and, being easily tamed, make very attractive pets.[1] Possessed of intense activity, their movements are the acme of grace and agility. They do not fly, in the usual sense of the term, but progress from tree to tree by gliding with outstretched membranes from an elevated position to a point lower down, usually near the ground. Just before alighting, the animal checks its momentum by sweeping upward in a gentle curve and alights on the tree trunk with its head up. Ascending the tree by climbing, it is ready for another flight. In these gliding leaps, which may extend for a distance of 50 yards or more, the squirrel is able to change its course to one side or the other with perfect ease.

Unlike all other American squirrels, the flying squirrels are strictly nocturnal. During the daytime they remain concealed in their nests and are never seen abroad unless frightened from their retreats. Usually they may be driven readily from their holes by pounding with an ax or club on the base of the tree in which they are

[1] A pair of flying squirrels regularly visit the sixth floor of an apartment house fronting the National Zoological Park, Washington, D. C., and although usually averse to the glare of an electric light, they will when hungry eat nuts in apparent unconcern within 5 or 6 feet of an observer. They run up and down the stuccoed sides of the building with perfect ease, doubtless reaching the middle stories by jumping from a near-by tree. Their visits usually are between dark and midnight.

sleeping. Woodchoppers frequently scare them out when felling timber, and anyone who camps frequently in the woods is likely to hear them at night running or jumping about in the trees or dropping nuts to the ground.

FIG. 1.—Map showing the distribution of *Glaucomys sabrinus* and *G. volans*, based on specimens examined and reports of occurrence.

VOICE.

The notes of *Glaucomys volans* are described by Vernon Bailey as a "fine, whistling squeak," and Wood says of the same species: "The

flying squirrel has three quite diverse calls or cries. It utters the usual 'chuck-chuck' of squirrels, the usual quick, sharp squeak when scolding, and also, more rarely, a clear musical note, commonly melodious and pleasant, but occasionally shrill. This resembles the chirp of a bird and may be kept up for ten minutes at a time."[1] Seton, writing of the northern flying squirrel, *G. sabrinus*, in Manitoba, says: "The cry of this species is said to be like that of *volans*, which is a prolonged squeak not unlike the complaint of a red-eyed vireo whose nest is threatened."[2]

NESTS.

These squirrels are found only in wooded regions, and for homes they depend chiefly on hollow trees or stubs and deserted woodpecker nests. They often take up their abode, also, in attics, in outbuildings, or in boxes constructed for martins or other birds. Audubon and Bachman mention finding a number of flying squirrels in crevices of rock at Red Sulphur Springs, Va. In the cavity chosen for a home a nest is constructed of shreds of bark, dry leaves, moss, feathers, fur, or other soft material. Outside nests are often built, or the deserted nests of birds or of other squirrels utilized. Concerning this habit (in *Glaucomys volans*) Mearns says:

> Not infrequently it builds outside nests, and even lives in them during the winter. Some resemble the leaf nests of the gray squirrel externally, though there is always a warm lining within; other nests are indistinguishable from those of red squirrels; and others still are deftly woven of the softest possible materials.[3]

Helme,[4] writing from Long Island, N. Y., and Rhoads,[5] writing from Pennsylvania, both mention this habit in *volans*, and both state that an evergreen tree usually is selected as a site for the nest. Evermann and Clark[6] speak of finding in Indiana a large globular nest of fibrous material situated in the crotch of a small oak; and King[7] describes a summer nest built of small twigs and oak leaves, and lined with grass, situated about 10 feet from the ground in a small oak.

The larger squirrels of the *sabrinus* group also occasionally construct outside nests, although, as is the case with *volans*, hollow trees usually are preferred. J. Ellis McLellan, at Gold Beach, Oreg., once found a flying squirrel occupying a small spherical nest made of sticks and moss placed in a small fir tree. Vernon Bailey, at McKenzie Bridge, Oreg., found soft nests of the flying squirrel in the

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[1] Wood, F. E., Bull. Illinois State Lab. Nat. Hist., VIII, pp. 535–536, 1910.
[2] Seton, E. T., Life Hist. Northern Anim., I, p. 441, 1909.
[3] Mearns, E. A., Bull. Amer. Mus. Nat. Hist., X, p. 342, 1898.
[4] Helme, A. H., Abstr. Proc. Linn. Soc. New York, Nos. 13–14, p. 23, 1902.
[5] Rhoads, S. N., Proc. Acad. Nat. Sci. Philadelphia, p. 389, 1894.
[6] Proc. Washington Acad. Sci., XIII, p. 15, 1911.
[7] King, F. H., Amer. Nat., XVII, p. 36, 1883.

masses of tree moss (*Hypnum*) which cover the trunks and branches of maple and ash trees in the deepest forest. There were runways up the trunks under the mossy fleece and others where the moss had been worn away by constant use. At Elk River, Minn., in November, 1904, Charles Bailey found two of the large flying squirrels (*G. sabrinus macrotis*) occupying a nest of sticks and moss in a small tamarack. At Florence, Mont., on June 11, 1910, Clarence Birdseye found in a pile of cordwood a flying squirrel's nest containing 4 young with eyes not yet open.

Flying squirrels apparently do not hibernate, but are known to lay up stores of food and to remain for a large part of the winter within their nests. During the winter and to some extent, also, at other seasons they are somewhat gregarious in habit. At Mullan, Idaho, in June, Clark P. Streator started 8 adults (*G. s. latipes*) from a hollow tree and secured 6 of them, all of which proved to be males. Seton mentions finding 9 adults (*G. s. canescens*) in a hollow stub at Carberry, Manitoba.[1] The same habit is possessed by *G. volans;* Prof. U. O. Cox, of Farmland, Ind., found, in November, 15 of these squirrels in a small rotten stub a little higher than a man's head,[2] and at Dothan, Ala., in March, the writer started 6 from a similar stub in a wooded swamp. Audubon and Bachman record finding 20 in a martin box having 8 or 10 apartments, placed on top of a large locust tree, the box being occupied, also, by bats and screech owls.[3] Dr. J. Schneck states that he once ran as many as 50 out of one den.[4] Audubon and Bachman narrate an interesting experience with flying squirrels near Philadelphia, Pa., where not less than 200 were observed at once about sunset engaged in sportive gambols in a grove of trees.[5]

BREEDING.

The number of young produced at a birth varies from 3 to 6—usually 4 or 5. The period of gestation is said to be one month,[6] but no definite evidence on this point is available. In the Northern States the young of *Glaucomys volans* are brought forth in April, and a second brood may be produced in August or September. Evermann and Clark[7] describe finding small naked young ones in Indiana on August 19, and Langdon[8] records young with eyes not yet open at Madisonville, Ohio, September 7.

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[1] Seton, E. T., Life Hist. Northern Anim., I, p. 441, 1909.
[2] Evermann and Clark, Proc. Washington Acad. Sci., XIII, p. 16, 1911.
[3] Audubon and Bachman, Quadr. North Amer., I, p. 220, 1846.
[4] Wood, F. E., Bull. Illinois State Lab. Nat. Hist., VIII, p. 534, 1910.
[5] Audubon and Bachman, Quadr. North Amer., I, p. 218, 1846.
[6] D. W. C., On the Habits of the American Flying Squirrels (*Pteromys volucella* Cuv.): Mag. Nat. Hist., IX, pp. 569–572, 1836.
[7] Evermann and Clark, Proc. Washington Acad. Sci., XIII, p. 15, 1911.
[8] Langdon, Frank W., Journ. Cincinnati Soc. Nat. Hist., III, p. 303, 1881.

The large flying squirrels of the *sabrinus* group apparently breed somewhat later than *volans*. Seton records a specimen taken at Winnipeg, Manitoba, on April 21, which contained 6 young ready for birth; and a nest of 4 young, with eyes not opened, found May 15[1]. Merriam found nursing young of *G. s. macrotis* about a month old in northern New York on June 18. In the Bitterroot Mountains, Mont., at 4,500 feet altitude, Clarence Birdseye took a female of *G. s. bangsi*, May 17, 1910, containing two large embryos; and in the Bitterroot Valley, near Florence, Mont., found a nest of small nursing young on June 11.

FOOD.

The food of flying squirrels consists in large part of nuts, including, probably, most of the native species—chestnuts, acorns, beechnuts, hickory nuts, pecans, and others. Catesby includes pine seeds and persimmon berries in their diet, and Prof. D. E. Lantz states that they frequently gather and store seeds of the cultivated cherry. Stomachs of three specimens of *volans* taken in Virginia in January contained finely chewed chestnut meats, a few pieces of acorn, and several beetle larvæ—probably secured with the nuts. Several stomachs taken at Red Fork, Okla., in June contained only remains of insect larvæ. Buds of trees are said to be eaten in winter, and corn or other grain sometimes is taken. Beetles and perhaps other insects constitute a part of the animals' fare. They have a decided taste for meat, and are so frequently caught by fur trappers in meat-baited traps set for larger game as to constitute a nuisance. Rowley states that he has known the small eastern species (*volans*) to gnaw the edges of meat hung from the rafters of an outhouse.[2] Flying squirrels are suspected by some observers of destroying the eggs of wild birds, and Merriam remarks that the eagerness with which these animals seize and feast upon a dead bird placed within their reach would indicate that they are not strangers to such a repast.[3] King states that in confinement they eat birds' eggs with great satisfaction, and relates an instance of the instant killing by them of a nestling chipping sparrow placed in their cage. A large moth introduced alive was also quickly captured and eaten.[4]

A writer in "Forest and Stream," describing the habits of flying squirrels in captivity, states that they were fond of parsley, pansy flowers, and apple-tree twigs, the last being devoured with great avidity, the leaves and bark stripped clean from the wood. This writer states also that the squirrels were fond of moths and grass-

[1] Seton, E. T., Life Hist. Northern Anim., p. 442, 1909.
[2] Rowley, J., Abstr. Proc. Linn. Soc. New York, Nos. 13–14, p. 40, 1902.
[3] Merriam, C. Hart., Trans. Linn. Soc. New York, II, p. 100, 1884.
[4] King, F. H., Amer. Nat., XVII, pp. 40–41, 1883.

hoppers, but refused crickets, and their preference in nuts was for acorns, filberts, and pecans.[1]

Stores of food laid up by flying squirrels for winter use have occasionally been found, indicating that the hoarding habit is probably general. Audubon and Bachman record an instance of a martin box occupied by a considerable number of flying squirrels, in which was found a quantity of hickory nuts, chestnuts, acorns, and corn.[2]

ECONOMIC STATUS.

The food habits of the flying squirrels are such that they are almost entirely harmless. So far as known they do not damage farm crops, and the relatively small number of nuts which they consume does not seriously affect the total supply. They have been suspected of destroying the eggs and young of wild birds, but no definite evidence on this point is forthcoming. Occasionally they may take possession of bird boxes or enter the lofts of dwelling houses and thus become objectionable, but ordinarily their gentle and confiding ways and their interesting habits make them desirable neighbors.

PELAGE AND MOLT.

The pelage in members of this genus is of moderate length, very dense, fine, and silky in texture. Apparently only one complete molt occurs in a year, in the autumn, from September to November. The new pelage usually appears first on the sides and spreads thence over the back, the head and shoulders being the last parts to be renewed. The effects of wear usually are not noticeable until March, but from then till November many worn specimens are to be found, though apparently a considerable proportion retain the winter pelage throughout the summer with little indication of wear. The head, nape, and rump are first subject to wear, though frequently the entire upperparts and tail become much worn. In summer there is a general tendency to a reddening of the hairs on the upperparts.

In *Glaucomys volans* and in most, if not all, of the races of *G. sabrinus* the middle portion of the soles in summer is naked, the same portions being furred in winter pelage in all forms except the southern races of *volans*. In one race (*G. volans volans*) the hind toes are conspicuously marked with white in winter, but are brown in summer. The exact manner of this change is not apparent, but it probably is accomplished by a partial spring molt.[3]

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[1] "C. C. H.," Forest and Stream, LII, pp. 125–126, 1899.

[2] Audubon and Bachman, Quad. North Amer., I, p. 220, 1846.

[3] For a detailed account of the molt in *G. volans* see, under that species, pp. 20–22.

EXPLANATION OF CRANIAL MEASUREMENTS.

The following measurements of skulls of this genus have been taken in millimeters:

Greatest length.—From anterior border of nasals to posterior border of supraoccipital in median line.

Zygomatic breadth.—Greatest breadth across zygomata.

Mastoidal breadth.—Greatest breadth across mastoids.

Interorbital breadth.—Shortest distance across frontals in front of postorbital processes.

Postorbital breadth.—Shortest distance across frontals behind postorbital processes.

Length of nasals.—Greatest length of nasals, measured along median line.

Maxillary toothrow.—Alveolar length of maxillary molar-premolar toothrow.

MATERIAL EXAMINED.

For the present revision the writer has assembled for study 1,052 specimens. About half of these are contained in the United States National Museum, including the Biological Survey and Merriam collections. The remainder have been borrowed from other American museums and from private collections, so that practically all the available material in this country has been at the disposal of the reviser.[1]

Genus GLAUCOMYS Thomas.

Mus Linnæus, Syst. Nat., Ed. 10, p. 63 (part), 1758.
Sciurus Pallas, Nov. Spec. Glires, p. 350 (part), 1778. Not *Sciurus* Linnæus, 1758.
Pteromys Tiedemann, Zool., I, p. 451 (part), 1808. Not *Pteromys* G. Cuvier, 1800.
Sciuropterus Lesson, Manuel de Mamm., p. 242, 1827 (part); Desmarest, Dict. Sci. Nat., p. 140, 1827 (part). Not *Sciuropterus*, F. Cuvier, 1825.
Glaucomys Thomas, Ann. and Mag. Nat. Hist. (ser. 8), I, p. 5, 1908. Type, *Mus volans* Linnæus.

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[1] For the loan of this material the writer desires to extend thanks to the owners and custodians as follows: Dr. J. A. Allen, of the American Museum of Natural History; Messrs. Samuel Henshaw and Outram Bangs, of the Museum of Comparative Zoology; Dr. Witmer Stone, of the Academy of Natural Sciences of Philadelphia; Messrs. Charles B. Cory and W. H. Osgood, of the Field Museum of Natural History; Dr. Joseph Grinnell, of the Museum of Vertebrate Zoology, University of California; Mr. P. A. Taverner, of the Victoria Memorial Museum; Mr. F. Kermode, of the Provincial Museum, Victoria, British Columbia; Dr. W. J. Holland and Mr. W. E. Clyde Todd, of the Carnegie Museum; Dr. A. G. Ruthven, of the University of Michigan; Mr. C. D. Bunker, of the Kansas University Museum; Mr. Myron H. Swenk, of the University of Nebraska; Mr. J. D. Figgins, of the Colorado Museum of Natural History; Mr. J. O. Snyder, of Leland Stanford, Jr., University; Dr. Barton W. Evermann, of the California Academy of Sciences; Mr. Henry L. Ward, of the Milwaukee Public Museum; Mr. W. E. Saunders, of London, Ontario; Mr. Edward R. Warren, of Colorado Springs, Colo.; Mr. G. L. Kirk, of Rutland, Vt., and Dr. H. V. Ogden, of Milwaukee, Wis.; and to Mr. Francis Harper for the photograph from which the frontispiece was made.

HISTORY AND NOMENCLATURE.

The small eastern flying squirrel (*Glaucomys volans*), which is very common in Virginia and the other South Atlantic States, attracted the notice of the earliest colonists and through their descriptions early became known to naturalists. Captain John Smith, in his History of Virginia, published originally in 1624, refers to the animal in the following words:

> A Small beast they have they call Assapanick, but we call them flying Squirrels, because spreading their legs, and so stretching the largenesse of their skins, that they have beene seene to fly 30 or 40 yards.[1]

This species was described more or less fully also in the seventeenth and eighteenth centuries by numerous other writers, including Ray,[2] Catesby,[3] and Edwards.[4] Both Catesby and Edwards figured the animal, and Catesby described its habits in the following words:

> These Squirrels are gregarious, travelling from one Tree to another in companies of ten, or twelve together. When I first saw them, I took them for dead Leaves, blown one Way by the Wind, but was not long so deceived, when I perceived many of them to follow one another in one Direction: They will fly fourscore Yards from one Tree to another. They can not rise in their Flight, nor keep in a horizontal Line, but descend gradually, so that in Proportion to the Distance the Tree, they design to fly to, is from them, so much the higher they mount on the Tree they fly from * * *.

The species of eastern Canada was briefly described by Sagard-Théodat in 1636,[5] and that of southern Mexico by Hernandez in 1651.[6]

GENERIC NAMES.

Placed first by Linnæus in the genus *Mus*, the American flying squirrels were later associated with *Sciurus* by Gmelin, Pallas, and Shaw. In 1800 G. Cuvier proposed a new genus, *Pteromys*, to include the European flying squirrel (*Sciurus volans* Linnæus) and the large East Indian species (*Sciurus petaurista* Gmelin). The American forms were referred by later writers to this genus. F. Cuvier, in 1823,[7] pointed out the characters distinguishing the American and European flying squirrels from the large Asiatic species, and in 1825 proposed the name *Sciuropterus* for the European animal,[8] but this name was not generally accepted until Allen adopted it for the American species in his monograph of the Sciuridæ (1877).[9] This

[1] Smith, John, The Generall Historie of Virginia, &c., p. 27, 1624.
[2] Ray, John, Synop. Quad., p. 215, 1693.
[3] Catesby, Mark, Nat. Hist. Carolina, II, pp. 76–77, 1743.
[4] Edwards, George, Nat. Hist. Birds, IV, p. 191, 1751.
[5] Sagard-Théodat, Gabriel, Hist. Canada, III, p. 745, 1636.
[6] Hernandez, F., Hist. Anim. et Min. Novæ., Hisp., p. 9, 1651: In Rerum Med. Novæ Hisp. Thesaurus.
[7] Cuvier, F., Mem. Mus. Hist. Nat., Paris, pp. 125–127, 1823.
[8] Cuvier, F., Dents des Mamm., p. 255, 1825.
[9] Allen, J. A., Monogr. North Amer. Rodentia: Rept. U. S. Geol. Surv. Terr., XI, p. 653, 1877.

name continued in current use until 1914, when Miller[1] showed that according to modern rules for fixing types it must give place to *Pteromys* of earlier date, the type of the latter having been fixed by Fleming,[2] in 1822, on *Sciurus volans*—the European flying squirrel. Thomas,[3] in 1908, in a revision of the genera of flying squirrels separated the American forms subgenerically from the European members of the genus under the name *Glaucomys*, and in 1915 the present writer raised the group to generic rank.[4]

SPECIFIC NAMES.

Linnæus, in the 10th edition of his Systema Naturæ,[5] described the smaller American species under the name *Mus volans*, basing his description mainly on the account of the animal as given by Ray. Curiously enough, on a later page of the same work he described the European flying squirrel as *Sciurus volans*. The two species naturally were united in one genus by later authors, and the duplication of the name *volans* necessitated the renaming of one of them. Pallas, therefore, in 1778,[6] proposed the name *volucella* for the American animal, which designation remained in general use until 1890, when Jordan revived the original name *volans*.[7] The larger American species was named *Sciurus hudsonius*, in 1788, by Gmelin,[8] but this name proved to be preoccupied by Erxleben's *Sciurus vulgaris hudsonicus* applied to the American chickaree, so, in 1801, Shaw proposed in its place the name *sabrinus*.[9] During the nineteenth century both these names were used for the northern flying squirrel—*hudsonius* by Baird, Allen, and others and *sabrinus* by Richardson, Audubon and Bachman, and others. Finally, in 1894, the nomenclatural question involved having been settled, Rhoads[10] revived the name *sabrinus*, which has remained current ever since. In addition to Pallas's name *volucella*, the small species *Mus volans* Linnæus was several times renamed during the early years of the nineteenth century. Tiedemann, in 1808, proposed for it the name *Pteromys virginianus*,[11] and Oken, in 1816, called the species *Pteromys americana*.[12]

Richardson, in 1828,[13] described a new species, *alpinus*, from material collected by Thomas Drummond in western Canada, but the fol-

[1] Miller, G. S., Proc. Biol. Soc. Washington, XXVII, p. 216, 1914.
[2] Fleming, J., Philos. Zool., II, p. 190, 1822.
[3] Thomas, O., Ann. and Mag. Nat. Hist. (ser. 8), I, p. 5, 1908.
[4] Howell, A. H., Proc. Biol. Soc. Washington, XXVIII, p. 109, 1915.
[5] Linnæus, Syst. Nat., Ed. 10, I, p. 63, 1758.
[6] Pallas, Nov. Spec. Glires, p. 351, 1778.
[7] Jordan, D. S., Man. Vert. U. S., Ed. 5, 321, 1890.
[8] Gmelin, J. F., Syst. Nat., I, p. 153, 1788.
[9] Shaw, Gen. Zool., II, p. 157, 1801.
[10] Rhoads, S. N., Amer. Nat., XXVIII, p. 525, 1894.
[11] Tiedemann, F., Zool., I, p. 451, 1808.
[12] Oken, Lorenz, Lehrb. der Naturg., II, p. 865, 1816.
[13] Richardson, J., Zool. Journ., III, p. 519, 1828.

lowing year he reduced the form to a subspecies of *sabrinus*.[1] Bachman, in 1839, named *oregonensis*, a new species from the lower Columbia River, and after this date no new names were proposed for the group for a period of more than 50 years.

Audubon and Bachman in their great work, the Quadrupeds of North America,[2] treated the four species already described—*volucella*, *sabrinus*, *alpinus*, and *oregonensis*. Baird, in his Mammals of North America,[3] recognized the same four species (using the name *hudsonius*, however, in place of *sabrinus*), but was able to add very little to the history of the group. Allen, in his Monograph of the Sciuridæ,[4] united the four forms into one species, *volucella*, with *hudsonius* as a variety, placing *alpinus* and *oregonensis* in synonymy. Bangs, in 1896, revised the eastern members of the genus, raising *sabrinus* again to the rank of a species and describing as new, *querceti*, a southern race of *volans*, and *silus*, a supposed new species from West Virginia.[5] Rhoads, in 1897, revised the western forms of the genus, reviving *alpinus* as a full species with *oregonensis* as a subspecies and describing three additional races—*fuliginosus* from the Cascade Mountains, Washington; *bangsi* from central Idaho; and *californicus* from the San Bernardino Mountains, California.[6]

During the next eight years 9 new forms were added by various authors to the 9 already recognized—one (*goldmani*) as a race of *volans* from southern Mexico, two (*macrotis* and *makkovikensis*) as races of *sabrinus*, five (*klamathensis*, *olympicus*, *lascivus*, *stephensi*, and *zaphæus*) as races of *alpinus*, and one (*yukonensis*) as a full species.

In 1915 Swenk proposed as new *Pteromys volans nebrascensis*, and the present writer described two races of *volans*, four of *sabrinus*, and one full species, *bullatus*,[7] thus raising the total number of recognized forms to 26. In the present revision all of these are recognized except *silus* of Bangs and *nebrascensis* of Swenk, which are referred to *G. volans volans*.

GENERIC CHARACTERS.

Form sciurine; fore and hind limbs connected by a broad fold of skin extending from wrists to ankles, supported anteriorly by a

[1] Fauna Boreali-Amer., I, p. 195, 1829.

[2] Audubon and Bachman, Quad. North Amer., I, pp. 132, 216, 1846; III, pp. 202, 206, 1854.

[3] Baird, S. F., Mamm. North Amer.: Rept. Expl. and Surv. R. R. Pac., VIII, pp. 286–290, 1857.

[4] Allen, J. A., Monogr. North Amer. Rodentia: Rept. U. S. Geol. Surv. Terr., XI, pp. 653–666, 1877.

[5] Bangs, O., Proc. Biol. Soc. Washington, X pp. 162–166, 1896.

[6] Rhoads, S. N., Proc. Acad. Nat. Sci. Philadelphia, pp. 314–327, 1897.

[7] Howell, A. H., Proc. Biol. Soc. Washington, XXVIII, pp. 109–114, 1915; in the present paper *bullatus* is treated as a subspecies of *sabrinus*.

slender cartilaginous process growing from the wrist. Tail broad, much flattened, densely haired, its sides usually nearly parallel or slightly narrowed at each end, the tip evenly rounded. Soles with 4 tubercles at base of toes; no metatarsal pad; palms with 5 tubercles—3 at base of fingers, one at base of the rudimentary thumb, and one opposite the latter on outside of wrist. Mammæ, 8, as follows: Pectoral, $\frac{1}{1}$; abdominal, $\frac{2}{2}$; inguinal, $\frac{1}{1}$. Skull with smoothly rounded braincase, flattened in some species, subglobular in others; nasals abruptly depressed at tip; dorsal outline of skull from nasals to postfrontal region nearly straight, then abruptly depressed to occiput; frontals long and narrow, the interorbital region decidedly longer than broad; interorbital constriction pronounced, usually with a distinct notch at anterior base of postorbital processes; postorbital processes broad at base, tapering abruptly to a point, slightly depressed at tip; zygomata moderately expanded posteriorly, less widely anteriorly; audital bullæ large, subcircular in outline, smoothly rounded; pterygoids slender and rather low, the hamular processes usually touching audital bullæ; dentition, $I, \frac{2}{2}$; PM, $\frac{4}{2}$; M, $\frac{6}{6}=22$; maxillary toothrows approximately parallel; anterior upper premolar very small, terete, its crown simple; transverse ridges of upper molariform teeth continuous.

The skull of *Glaucomys* differs from that of *Pteromys*[1] in the following particulars (see Pl. VII, figs. 11–14): Rostrum with sides not parallel, but tapering gradually from tip to point of union with the zygomata; nasal branches of premaxillæ relatively much wider; zygomata narrower anteriorly, not standing out squarely from the rostrum; maxillary arm of zygoma much weaker, the median portion of the arch nearly vertical (nearly horizontal in *Pteromys*); frontals relatively longer and narrower, the surface nearly flat or with a very slight depression; postorbital processes broader at the base and less attenuate; braincase more swollen, its outlines smooth and rounded; occiput not noticeably depressed; anterior palatine foramina relatively smaller; mandible relatively longer and more slenderly built, the masseteric ridge less strongly developed, terminating at a point slightly posterior to the premolar; angular process weaker, its border forming a regular curve (not abruptly bent outwards, as in *Pteromys*); coronoid process larger and longer; enamel pattern of molariform teeth simple, the transverse ridges of the upper molars complete (in *Pteromys* PM^4, M^1, and M^2 having the posterior ridge cut by a deep reentrant fold).

[1] As restricted to the small palæarctic species *P. volans, P. büchneri,* and related forms.

List of Species and Subspecies, with Type Localities.

Glaucomys volans group:

Glaucomys volans volans (Linnæus)——Virginia.
volans saturatus Howell——Dothan, Alabama.
volans querceti (Bangs)——Citronelle, Florida.
volans texensis Howell——Sour Lake, Texas (7 miles northeast).
volans goldmani (Nelson)——Teopisca, Chiapas (20 miles southeast).

Glaucomys sabrinus group:

Glaucomys sabrinus sabrinus (Shaw)——Mouth of Severn River, Ontario.
sabrinus makkovikensis (Soruborger)——Makkovik, Labrador.
sabrinus macrotis (Mearns)——Hunter Mountain (Catskills), Greene County, New York.
sabrinus canescens Howell——Portage la Prairie, Manitoba.
sabrinus bangsi (Rhoads)——Idaho County, Idaho.
sabrinus alpinus (Richardson)——Jasper House, Alberta.
sabrinus yukonensis (Osgood)——Camp Davidson, Yukon River, Yukon.
sabrinus zaphœus (Osgood)——Helm Bay, Cleveland Peninsula, Alaska.
sabrinus oregonensis (Bachman)——"Pine woods of the Columbia, near the sea"—probably near the present site of St. Helens, Oregon.
sabrinus columbiensis Howell——Okanogan, British Columbia.
sabrinus fuliginosus (Rhoads)——Cascade Mountains, near Martin Station, Kittitas County, Washington.
sabrinus latipes Howell——Glacier, British Columbia.
sabrinus olympicus (Elliot)——Happy Lake, Olympic Mountains, Washington.
sabrinus bullatus Howell——Sawtooth [Alturas] Lake, Idaho.
sabrinus klamathensis (Merriam)——Fort Klamath, Oregon.
sabrinus flaviventris Howell——Head of Bear Creek, Trinity County, California.
sabrinus lascivus (Bangs)——Tallac, Eldorado County, California.
sabrinus californicus (Rhoads)——Squirrel Inn, San Bernardino Mountains, California.
sabrinus stephensi (Merriam)——Sherwood, Mendocino County, California.

Key to Species and Subspecies.

a^1. Hairs on belly white at roots (*volans* group).
b^1. Colors paler (drab, pinkish cinnamon, or yellowish wood brown).
c^1. Size larger; hind toes white in winter pelage——**volans** (p. 19).
c^2. Size smaller; hind toes not white in winter.
d^1. Skull relatively short and broad (greatest length, 32.7–34 mm.); bullæ smaller——**texensis** (p. 27).
d^2. Skull relatively long and narrow (greatest length, 33.2–35.3); bullæ larger——**querceti** (p. 26).

b^2. Colors darker (dark sayal brown; hair brown; pale snuff brown).
c^1. Sides of face marked with fuscous_____**goldmani** (p. 28).
c^2. Sides of face not marked with fuscous_____**saturatus** (p. 24).
a^2. Hairs on belly gray at roots (*sabrinus* group).
b^1. Bullæ very large_____**bullatus** (p. 51).
b^2. Bullæ medium or small.
c^1. Soles yellowish.
d^1. Underparts strongly yellowish_____**flaviventris** (p. 54).
d^2. Underparts not strongly yellowish.
e^1. Underparts tinged with yellow or cream-buff.
f^1. Under side of tail darker (deep pinkish cinnamon), **columbiensis** (p. 45).
f^2. Under side of tail paler (light pinkish cinnamon or colonial buff)_____**klamathensis** (p. 52).
c^2. Underparts tinged with avellaneous_____**lascivus** (p. 55).
c^2. Soles not yellowish.
d^1. Underparts heavily washed with wood brown or some shade of cinnamon or buff.
e^1. Upperparts strongly rufescent (mikado brown or pecan brown), **oregonensis** (p. 44).
e^2. Upperparts not strongly rufescent.
f^1. Tail strongly clouded with fuscous beneath_____**zaphæus** (p. 43).
f^2. Tail not strongly clouded with fuscous beneath.
g^1. Size larger (greatest length of skull usually more than 42 mm.), **latipes** (p. 48).
g^2. Size smaller (greatest length of skull usually less than 42 mm.).
h^1. Colors darker (wood brown to snuff brown), **olympicus** (p. 49).
h^2. Colors paler (pale sayal brown)_____**fuliginosus** (p. 47).
d^2. Underparts whitish, or moderately washed with wood brown or some shade of cinnamon or buff.
e^1. Upperparts vinaceous or brownish (pinkish cinnamon, vinaceous-cinnamon, or sayal brown).
f^1. Upperparts very pale (light pinkish cinnamon)___**canescens** (p. 37).
f^2. Upperparts darker (vinaceous-cinnamon to sayal brown).
g^1. Underparts white or faintly washed with pinkish cinnamon or wood brown.
h^1. Size larger (greatest length of skull in adults more than 39 mm.).
i^1. Under side of tail strongly washed with fuscous or dark brown.
j^1. Size larger (greatest length of skull usually more than 40.4 mm.)_____**makkovikensis** (p. 34).
j^2. Size smaller (greatest length of skull usually less than 40.4 mm.)_____**sabrinus** (p. 31).
i^2. Under side of tail not strongly washed with fuscous (pale or deep pinkish cinnamon).
j^1. Upperparts vinaceous-cinnamon_____**columbiensis** (p. 45).
j^2. Upperparts sayal brown_____**stephensi** (p. 57).
h^2. Size smaller (greatest length of skull less than 39 mm.), **macrotis** (p. 35).

g^2. Underparts moderately washed with pinkish cinnamon or avellaneous.
h^1. Size larger (average length of tail about 165 mm.), yukonensis (p. 41).
h^2. Size smaller (average length of tail about 142 mm.), bangsi (p. 38).
e^2. Upperparts drab, gray, or wood brown.
f^1. Size larger; tail heavily marked with fuscous——alpinus (p. 40).
f^2. Size smaller; tail not heavily marked with fuscous.
g^1. Under side of tail deep pinkish cinnamon——bangsi (p. 38).
g^2. Under side of tail pinkish buff or pale olive-buff.
h^1. Skull with deeper braincase; soles never washed with yellow or buff——stephensi (p. 57).
h^2. Skull with shallower braincase; soles often washed with yellow or buff.
i^1. Larger and darker——lascivus (p. 55).
i^2. Smaller and paler——californicus (p. 56).

DESCRIPTIONS OF SPECIES AND SUBSPECIES.

Glaucomys volans Group.

GLAUCOMYS VOLANS (LINNÆUS).

[Synonymy under subspecies.]

General characters.—Size small (hind foot 32 mm. or less); hairs on underparts white to the roots, except on hind legs and flying membranes, where they are plumbeous at base.

Cranial characters.—Skull small (greatest length 35.7 mm. or less); rostrum short; audital bullæ moderately inflated.

Color.—Upperparts drab, pinkish cinnamon, sayal brown, pale snuff brown, hair-brown, or yellowish wood brown, the bases of the hairs deep neutral gray; sides of face smoke gray, often shaded with fuscous or buff; borders of flying membrane above, fuscous, clove brown, or blackish brown; fore feet buffy white, hair-brown, or grayish buff; hind feet hair-brown, fuscous, or mouse gray, the toes in one race white in winter; tail above, hair-brown, snuff brown, verona brown, fuscous, or drab; beneath, pinkish cinnamon, vinaceous-cinnamon, or pinkish buff; underparts creamy white, the sides often edged with pinkish cinnamon, vinaceous-cinnamon, or pinkish buff.

Geographic distribution.—Eastern United States and extreme southern Canada, from southern New Hampshire, northern New York (Lewis County), southern Ontario (London), central Michigan, northern Wisconsin (Burnett County), and central Minnesota (Aitkin County), south to the Gulf coast and southern Florida (Fort Myers); west to eastern Nebraska (Otoe and Nemaha Counties), eastern Kansas (Douglas and Woodson Counties), southwestern Oklahoma (Wichita Mountains), and eastern Texas (Parker, Bastrop, and DeWitt Counties); also the highlands of Chiapas and

Guatemala and probably locally throughout eastern Mexico. Zonal range from the Transition through Upper and Lower Austral Zones (fig. 2).

GLAUCOMYS VOLANS VOLANS (LINNÆUS).

SMALL EASTERN FLYING SQUIRREL.

[Pl. I; Pl. II, fig. 2; Pl. IV, fig. 2; Pl. VI, fig. 1.]

[*Mus*] *volans* Linnæus, Syst. Nat., ed. 10, p. 63, 1758 (based chiefly on Ray and Edwards).

Sciurus volucella Pallas, Nov. Spec. Glires, p. 351, 1778 (apparently a renaming of *Mus volans* Linnæus, but based primarily on Edwards and Catesby).

Pteromys virginianus Tiedemann, Zool., I, p. 451, 1808 (renaming of *Mus volans* Linnæus).

Pteromys americana Oken, Lehrb. der Naturg., II, p. 865, 1816 (renaming of *Sciurus volucella* Pallas).

Pteromys volucella Desmarest, Nouv. Dict. d'Hist. Nat., XXVII, p. 406, 1818; Audubon and Bachman, Quad. North Amer., I, p. 216, 1846, plate XXVIII; Baird, Mamm. North Amer.: Rept. Expl. and Surv. R. R. Pac., VIII, p. 286, 1857.

Sciuropterus volucella Lesson, Manual de Mamm., p. 242, 1827.

Sciuropterus americanus Desmarest, Dict. Sci. Nat., p. 140, 1827.

FIG. 2.—Map showing the distribution of the subspecies of *Glaucomys volans*, based on specimens examined.

? *Pteromys cucullatus* Fischer, Synop. Mamm., p. 365, 1829 (type locality, Virginia (?); based on the "*Sciurus, Virginianus, volans*" of Seba).[1]

Sciuropterus volucella var. *volucella* Allen, Proc. Boston Soc. Nat. Hist., XVI, p. 189, 1874; Monogr. North Amer. Rodentia: Rept. U. S. Geol. Surv. Terr., XI, p. 655, 1877.

[1] Seba's figure does not agree with any known species of flying squirrel; Thomas (Proc. Zool. Soc. London, p. 148, 1911) has identified it as a young *Petaurista*, but the flattened tail strongly suggests *Glaucomys;* Linnæus cites Seba's description in the synonymy of *Mus volans*.

S[ciuropterus] volans Jordan, Man. Vert. U. S., ed. 5, p. 321, 1890.

Sciuropterus silus Bangs, Proc. Biol. Soc. Washington, X, p. 163, 1896. Type, No. 4931, Mus. Comp. Zool. (formerly in collection E. A. & O. Bangs); from top of Katis Mountain, near White Sulphur Springs, West Virginia; September 2, 1895.

Pteromys volans nebrascensis Swenk, University Studies (Lincoln, Nebraska), XV, p. 151, "April" [= Sept. 25], 1915. Type, No. 286, Coll. State Entomologist, Univ. Nebraska; from Nebraska City, Nebr., Nov. 26, 1914.

Type locality.—Virginia.[1]

Distribution.—Northeastern United States and extreme southern Canada, from central Minnesota, Wisconsin, and Michigan, southern Ontario, northern New York (Lewis County), and southern New Hampshire south to North Carolina (Raleigh), Tennessee (Nashville), and northern Arkansas and Oklahoma (Boston Mountains); west to eastern Nebraska (Otoe and Nemaha Counties) and eastern Kansas (Douglas and Woodson Counties).

Characters.—Size large (for the group); colors pale; upperparts varying from drab to pinkish cinnamon; toes, in winter, usually strongly marked with white and soles haired to the bases of the toes.

Color.—*Winter pelage:* Upperparts varying from drab through numerous intermediate shades to pinkish cinnamon, shaded along sides with pinkish buff; hairs on back with an indistinct, subterminal band of brown (not visible on the surface), their bases deep neutral gray; sides of face smoke gray, often washed with pinkish buff; eye-ring fuscous or clove brown; ears hair-brown or drab, scantily haired; upper surface of flying membrane fuscous to blackish brown; under surface edged with light pinkish cinnamon; underparts white, with a creamy tinge, the hairs white to the roots (except on hind legs, where their bases are neutral gray); tail, above, snuff brown to drab, shading on sides to hair-brown; beneath, light pinkish cinnamon to pinkish buff, shaded in some specimens with drab-gray; front feet buffy white or hair-brown, sometimes shaded with gray; hind feet hair-brown (rarely mouse gray), the toes and inner borders of feet white. *Summer pelage:* Similar to the winter pelage, but general tone of upperparts usually darker, caused in part by reddening of the hairs and in part by wearing away of the tips, thus exposing portions of the underfur; toes without white markings; middle portion of soles naked.

Molt.—From the large series of skins of this race which have been examined it has been possible to assemble a series of 97 specimens representing every month in the year and showing fully all the pelage gradations from one season to another. The following notes on the

[1] Fixed by Elliot, Synop. Mamm. North Amer.: Field Columb. Mus., Zool. Ser., II, p. 109, 1901 (see also Thomas, Proc. Zool. Soc. London, p. 148, 1911).

pelage of these specimens, arranged chronologically, will serve to make clear the time and manner of molting:

December.—Five specimens, all in full unworn pelage; hind feet white, the soles fully haired.

January.—Seven specimens, all in full unworn pelage excepting one (Virginia, January 18), which is slightly worn on rump; hind feet of all, white; soles haired.

February.—Eight specimens, all in full unworn pelage; hind feet white and soles haired.

March.—Fourteen specimens; ten in full unworn pelage; four adults (Washington, D. C., March 1) show considerable wear on head, nape, and rump; one immature specimen (White Sulphur, West Virginia, March 1) is slightly worn on head; all have white feet and hairy soles.

April.—Thirteen specimens; four in full pelage showing little wear; six much worn on head and nape; two considerably worn on entire upperparts and one on flanks; all but one have white feet and all but one (Long Island, New York, April 15), hairy soles.

May.—Seven specimens; two young individuals (Maryland, May 13) in much-worn pelage have brown feet, the soles hairy; one young from Wisconsin (June 10) is similar, but shows little wear; one adult (West Virginia, May 17) is in full pelage, but has brown feet and naked soles; two adults in full unworn pelage, except on head, have white feet but naked soles; one adult (Mount Graylock, Mass., May 6) is slightly worn on head, having white feet and hairy soles.

June.—Eight specimens; four moderately worn; three in full unworn pelage; one worn on head only; one (Washington, D. C., June 20) practically same as winter specimens (except feet); feet dusky, without white markings (except in one from Massachusetts, June 27, in which white on toes is faintly indicated.)

July.—Eleven specimens; three young nearly full grown (July 23, 27); two from Massachusetts (July 3, 26), practically full-grown young, show considerable wear; adults show only moderate wear on body, considerable on tail; one (July 28, Washington, D. C.) has pelage as full as in winter, but redder; feet dusky; soles naked.

August.—Two specimens; one (Lake George, New York, August 30) is somewhat worn on head, very little on body; another (Massachusetts, August 30) shows considerable wear on upperparts and tail; feet dusky.

September.—Eight specimens; four show little wear; two young are considerably worn; one adult (September 6, Maryland) is much worn, especially on nape and tail; one (Lake George, New York, September 15) has practically completed the body molt, except on head and a small area in middle of hinder back; feet dusky and soles naked.

October.—Five specimens; one young (October 21) shows little wear; one adult (Sing Sing, N. Y., October 17) apparently still retains the old pelage, which is little worn except on head and tail; feet noticeably whitened, but soles naked; three adults (Massachusetts, October 21; Virginia, October 19) are molting all over the upperparts, the feet still dusky and soles naked.

November.—Nine specimens; two immature individuals from Maryland are much worn and in process of molting; one adult from Maryland (♂, November 9) still retains old pelage on back, being much worn on head and nape, but fresh pelage seems to be coming in on sides of body; feet drab without white markings and soles naked; one adult (Washington, D. C., November 1) has completed the body molt except on head and a patch on nape; the toes on hind

feet are slightly whitened, and the hair is encroaching on the soles; five adults from Connecticut (November 26) are in full winter pelage, with white feet and hairy soles.

Skull.—Largest of the group; superior outline straight from nasals to postfrontal region; braincase moderately depressed, squarish in general outline.

Measurements.—Average of 16 adults from District of Columbia and adjacent parts of Virginia and Maryland: Total length, 232 (220–240); tail vertebræ, 101 (90–110); hind foot, 30.4 (29–32). *Skull:* Average of 12 adults from District of Columbia: Greatest length, 34.9 (34.1–35.6); zygomatic breadth, 21 (20.4–22.2); mastoidal breadth, 17.1 (16.5–17.7); least interorbital breadth, 6.9 (6.2–7.6); least postorbital breadth, 9.1 (8.6–9.6); length of nasals, 9.6 (9.2–10.1); maxillary toothrow, 6.4 (6.2–6.7).

Type specimen.—None known to exist.

Remarks.—This flying squirrel has an extensive range, and although individual variation within the subspecies is considerable, there is practically no variation which can be correlated with faunal areas. Large series of specimens are available from nearly all parts of its range, and careful comparison fails to reveal any appreciable differences between those of the New England States on the one hand and those of Minnesota, Iowa, Kansas, and Nebraska on the other. On the southern border of the range, however, a gradual darkening of the color of the upperparts is noticeable, and also a tendency toward elimination of white on the toes in winter pelage. Specimens from Virginia (the type region), however, do not differ appreciably from New England and New York individuals. Specimens from Raleigh, N. C., and from Stillwell, Okla., show decided approach in characters to *saturatus;* a single winter specimen from Gainesville, Tex., although approaching *texensis* in skull characters, agrees almost exactly with typical *volans* in color and in having white toes. Since this specimen shows no approach to *saturatus* (which occurs at Red Fork, in the Arkansas Valley), it seems probable that typical *volans* ranges from Kansas into western Oklahoma, perhaps as far as the Wichita Mountains, and thence into northern Texas. A single specimen in summer pelage from Oklahoma City, although somewhat indeterminate in characters, seems to bear out this theory of distribution. Additional material from that part of Oklahoma is needed to settle the question.

The type of *Sciuropterus silus* Bangs has been examined and proves to be an immature individual of *volans*, evidently a runt. A considerable series is now available from the type locality of *silus*, and all are perfectly typical of *volans*.

The type of *Pteromys volans nebrascensis* Swenk has been examined and found to agree essentially with typical specimens of *volans*

from the vicinity of Washington, D. C. It is a rather pronounced example of the gray phase, and, although taken on November 26, the hind toes have not yet acquired the clear white which characterizes the winter pelage. The hind feet are somewhat darker than the average of *volans*—in this respect agreeing with *saturatus*. The tail measurement of the type (115 mm.) is about 14 mm. more than the average, but only 5 mm. more than the extremes of *volans*. In the dried skin, however, the tail does not measure any longer than in dozens of typical specimens. The skull and hind feet measure exactly as in typical examples.

Specimens examined.—Total number, 356, as follows:

Connecticut: East Hartford, 5;[1] Liberty Hill, 8.[2]
District of Columbia: Cleveland Park, 13; Washington, 23.
Illinois: Belleville, 1; Chicago, 2; Golconda, 1;[3] Olive Branch, 1;[3] Olney, 2; Parkersburg, 1; Warsaw, 8; Willow Springs, 1.[3]
Indiana: Denver, 2;[2, 4] Kankakee, 1;[3] La Porte, 1;[3] Wheatland, 1.
Iowa: Hillsboro, 2; Iowa City, 1;[5] Knoxville, 3; Thayer, 2.[5]
Kansas: Douglas County, 5;[6] Lawrence, 11;[5] Topeka, 4;[6] Woodson County, 1.[7]
Kentucky: Eubanks, 3.
Maryland: Bacon Hill, 3;[8] Branchville, 1; Capitol View, 1; Garrett Park, 1; Kensington, 2; Laurel, 3; Marlboro, 1; Marshall Hall, 2; Oxon Hill, 1; Plummer Island, 2; Prince Georges County, 3; Silver Spring, 2.
Massachusetts: Ipswich, 1; Mount Graylock, 1; Wareham, 4;[2] Waverly, 2;[2] Wilmington, 2; Woburn, 1.
Michigan: Ann Arbor, 4;[4] Brooklyn, 1;[4] Dexter, 1;[4] Iosca, 1;[4] Ithaca, 2;[4] Kavanagh Lake, 3;[4] Lodi Township, Washtenaw County, 1;[4] Napoleon, 1;[4] Portage Lake, 2;[4] Sand Point, 10;[4] Ypsilanti, 1.[4]
Minnesota: Aitkin, 1;[3] Bridgman, 2; Elk River, 19; Fort Snelling, 3; Steele County, 2.[8]
Missouri: Independence, 1; Stotesbury, 1.[2]
New Hampshire: Hancock, 2.[2]
New Jersey: Cape May County, 1;[9] Culvers Gap, Sussex County, 1;[8] Ellenville, 1; Haddonfield, 5;[8] Lake Hopatcong, 4;[8] Seaville, 2.[8]
New York: Ardsley, 3;[3, 9] Geneva, 1; Hastings, 7;[9] Jamaica, 1; Lake George, 5; Lake Grove, 2; Locust Grove, 5; Miller Place, 5;[9] Sing Sing, 7; Suffolk County, 1.[8]
North Carolina: Apex, 1;[3] Raleigh, 20.[10]
Ohio: Fort Ancient, 1;[9] Madisonville, 3; Ravenna, 1.[9]
Oklahoma: Oklahoma City, 1; Stilwell, 7.
Ontario: Kingsville, 1;[11] London, 7.[11]

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[1] Three in collection Acad. Nat. Sci. Philadelphia.
[2] Collection Mus. Comp. Zool.
[3] Collection Field Mus. Nat. Hist.
[4] Collection Univ. Michigan.
[5] Collection D. Stoner, Iowa City, Iowa.
[6] Collection Kansas Univ. Mus.
[7] Collection Colorado Mus. Nat. Hist.
[8] Collection Acad. Nat. Sci. Philadelphia.
[9] Collection Amer. Mus. Nat. Hist.
[10] Nine in collection Amer. Mus. Nat. Hist.
[11] Collection W. E. Saunders, London, Ont.

Pennsylvania: Carlisle, 1; Chester County, 2; Drury Run, Clinton County, 1; Huntingdon Furnace, 1;[1] Leasuresville, 3;[1] Moon Township, Allegheny County, 1;[2] Pine Grove Furnace, 1.[2]

Tennessee: Nashville, 1.[3]

Texas: Gainesville, 2.

Vermont: Castleton, 1;[4] Rutland, 2.[4]

Virginia: Cherrydale, 1; Dranesville, 1; Dunn Loring, 4; Falls Church, 8; Fort Myer, 1; Henrico County, 1; Maywood, 1; Mount Rodgers, Grayson County, 2; Mount Vernon, 7; Nelson County, 2;[3] Suffolk, 1; Warwick County, 2.

West Virginia: Travellers Repose, 2; White Sulphur Springs, 13.[5]

Wisconsin: Beaver Dam, 2;[6,7] Cassville, 1;[3] Delavan, 1; Lake Koshkonong, 1;[7] Racine, 1.

GLAUCOMYS VOLANS SATURATUS Howell.

SOUTHEASTERN FLYING SQUIRREL.

[Pl. II, fig. 1; Pl. IV, fig. 1; Pl. VI, fig. 3.]

Glaucomys volans saturatus Howell, Proc. Biol. Soc. Washington, XXVIII, p. 110, May 27, 1915.

Type locality.—Dothan, Alabama.

Distribution.—Southeastern United States (excepting peninsular Florida and the coast region of Georgia) from South Carolina and western North Carolina west to central Oklahoma and north in the Mississippi Valley to southwestern Kentucky.

Characters.—Similar in size and skull characters to *volans*, but upperparts darker at all seasons; toes not conspicuously whitened in winter. Compared with *querceti:* Colors averaging darker, face grayer (less buffy), and hind feet grayer (less brownish); soles haired in winter.

Color.—*Winter pelage:* Upperparts pale snuff brown or dark sayal brown, varying to hair-brown; sides of face smoke gray, rarely with a tinge of buff; upper surface of flying membrane dark clove brown or blackish brown; hind feet hair-brown, the toes washed with buff; fore feet grayish buff; tail above, snuff brown, shaded with bister or dark hair-brown (rarely solid hair-brown); beneath, pinkish cinnamon or vinaceous-cinnamon (rarely light hair-brown, washed with pinkish cinnamon); underparts creamy white, the under surface of the membranes edged with light pinkish cinnamon or light vinaceous cinnamon. *Summer pelage:* Essentially as in winter, but hind feet

[1] Collection Acad. Nat. Sci. Philadelphia.
[2] Collection Carnegie Mus.
[3] Collection Mus. Comp. Zool.
[4] Collection G. L. Kirk, Rutland, Vt.
[5] Ten in collection Mus. Comp. Zool.; two in Field Mus. Nat. Hist.
[6] Collection Mus. Vert. Zool., Univ. California.
[7] Collection E. R. Warren, Colorado Springs, Colo.

fuscous. *Variation* (March specimens from Milton, Florida): Upperparts rich pecan brown.

Skull.—Closely similar to that of *volans*, but averaging smaller; practically same size as that of *querceti*, but bullæ averaging smaller.

Measurements.—Average of 12 adults from southern Alabama:[1] Total length, 226 (211–244); tail vertebræ, 100 (84–109); hind foot, 30 (28–33). *Skull:* Average of 10 adults from southern Alabama:[2] Greatest length, 34 (32.8–34.9); zygomatic breadth, 20.3 (19.9–21.1); mastoidal breadth, 17 (16.6–17.5); least interorbital breadth, 7 (6.7–7.8); least postorbital breadth, 8.9 (8.3–10); length of nasals, 9.4 (8.8–10); maxillary tooth row, 6.4 (6.2–6.8).

Type specimen.—No. 178366, U. S. Nat. Mus. (Biological Survey collection); ♀ ad., skin and skull; collected March 13, 1912, by A. H. Howell.

Remarks.—This race is the darkest form in the *volans* group, differing in this respect both from the Florida form (*querceti*) and from the Texas form (*texensis*). It is much darker than *volans*, both in winter and in summer. Its range is chiefly in the Lower Austral Zone, but extends into the Upper Austral in the mountains of eastern Tennessee and western North Carolina. Intergradation with *volans* is shown by a series from Magnetic City, foot of Roan Mountain, North Carolina, and with *querceti* by a series from Pinetucky, Ga. The Pinetucky specimens are typical of *saturatus* in skull characters, but average paler in color. By reason of lack of material from Louisiana, the relationship of this race to *texensis* and its western limits in that State can not be defined. Specimens from Red Fork, Okla., are typical but in the Boston Mountains intergradation with *volans* occurs.

Two specimens in full winter pelage from Milton, Fla., differ from typical *saturatus* in having the upperparts pecan brown instead of snuff brown. These at first were thought to represent an undescribed race, but the recent acquisition of 3 adult specimens from Muscogee, Fla., only a few miles from Milton, which do not differ in any way from typical *saturatus*, leads to the conclusion that the Milton specimens represent a color phase of this race.

Specimens examined.—Total number, 89, as follows:

Alabama: Ardell, 4; Autaugaville, 10; Carlton, 2; Dothan, 6; Greensboro, 2; Mobile, 4; Perdido River, 1; Sand Mountain, near Carpenter, 2; York, 1.

Arkansas: Delight, 2.

Florida: Milton, 2; Muscogee, 2.

Georgia: Columbus, 1; Okefenokee Swamp, 2; Pinetucky, 13; Reidsville, 2; Young Harris, 1.

Kentucky: Hickman, 1.

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[1] Dothan, Autaugaville, Carlton, and York.

[2] Dothan, Autaugaville, Carlton, and Greensboro.

Louisiana: Mer Rouge, 2; Powhatan Plantation, near Gibson, 1.[1]
Mississippi: Columbus, 1; Washington, 1.
North Carolina: Cranberry, 1; Magnetic City, foot of Roan Mountain, 9.
Oklahoma: Red Fork, 4.
South Carolina: Calhoun Falls, 4;[2] Cleora, 1; Greenville, 1; Plantersville, 3; Santee, 1.
Tennessee: Watauga Valley, 2.

GLAUCOMYS VOLANS QUERCETI (Bangs).

Florida Flying Squirrel.

[Pl. II, fig. 9; Pl. IV, fig. 9; Pl. VI, fig. 2.]

Sciuropterus volans querceti Bangs, Proc. Biol. Soc., Washington, X, p. 166, Dec. 28, 1896.
[*Sciuropterus volucella*] *querceti* Trouessart, Cat. Mamm., I, p. 402, 1897.

Type locality.—Citronelle, Florida.

Distribution.—Peninsular Florida (south at least to Fort Myers) and the coast region of Georgia.

Characters.—Very similar in size and color to *volans*, but upperparts averaging slightly darker; toes without conspicuous white markings in winter; soles partly naked at all seasons; skull with larger audital bullæ.

Color.—*Winter pelage:* Upperparts sayal brown to yellowish wood brown, shaded on sides and fore legs with pinkish buff or light pinkish cinnamon; upper surface of flying membrane blackish brown; ears fuscous; sides of face smoke gray, often clouded with fuscous or buff; hind feet pale fuscous, the toes grayish buff; front feet whitish buff; tail above, snuff brown or verona brown, shading (when worn) to dark hair-brown; beneath, pinkish buff or pinkish cinnamon; underparts creamy white, often irregularly shaded with pinkish buff or pinkish cinnamon, particularly along edges of flying membranes. *Summer pelage:* Essentially the same as in winter, but averaging slightly browner (less drab) above.

Skull.—Closely similar to that of *volans*, but averaging slightly smaller, with larger audital bullæ.

Measurements.—Average of 8 adults from Florida:[3] Total length, 229 (221–253); tail vertebræ, 94 (81–115); hind foot, 31 (30–32). *Skull:* Average of 13 adults from Florida:[4] Greatest length, 34.3 (33.2–35.3); zygomatic breadth, 20.5 (19.1–21.3); mastoidal breadth, 17.4 (16.8–18.4); least interorbital breadth, 7 (6.5–7.3); least postorbital breadth, 8.5 (8.2–8.9); length of nasals, 9.4 (8.7–10); maxillary toothrow, 6.4 (5.9–7.1).

[1] Collection Mus. Comp. Zool.
[2] Collection Field Mus. Nat. Hist.
[3] Citronelle and Enterprise.
[4] Citronelle, Enterprise, Lake Harney, and New Berlin.

Type specimen.—No. 2451, Mus. Comp. Zool. (formerly same number, collection E. A. and O. Bangs); ♀ ad., skin and skull; collected September 17, 1894, by F. L. Small.

Remarks.—The Florida flying squirrel resembles *volans* very closely in color, but is easily distinguished in winter pelage by the absence of white markings on the toes and by naked soles. Compared with *saturatus* it averages considerably paler. The large size of the audital bullæ seems to be only an average character, for while pronounced in some specimens, others do not differ in this respect from typical *volans*. The type specimen has larger bullæ than have two topotypes and, indeed, can scarcely be matched in this character by any of the Florida specimens examined. Intergradation with *saturatus* takes place in southeastern Georgia. Specimens from St. Marys, Ga., agree in color with *querceti*, but have smaller bullæ; some individuals in the series have the hind toes marked with buffy white, but less extensively than in *volans*. Considerably more material from Florida and Georgia is needed to show the average characters and exact distribution of this race.

Specimens examined.—Total number, 67, as follows:

Florida: Citronelle, 3;[1] Enterprise, 10;[2] Fort Myers, 1;[1] Gainesville, 2;[3] Hernando County, 2; Lake Harney, 2; Nassau County, 2;[3] New Berlin, 13;[1] Ocala, 1; Shell Hammock, 2; Tarpon Springs, 9.[4]

Georgia: McIntosh County, 1;[1] Montgomery, 4;[1] St. Marys, 15.[1, 3, 5, 6]

GLAUCOMYS VOLANS TEXENSIS Howell.

Texas Flying Squirrel.

[Pl. II, fig. 5; Pl. IV, fig. 5; Pl. VI, fig. 4.]

Glaucomys volans texensis Howell, Proc. Biol. Soc. Washington, XXVIII, p. 110, May 27, 1915.

Type locality.—Sour Lake, Texas (7 miles northeast).

Distribution.—Eastern Texas, west to Aledo, Gurley, Elgin, and Cuero; eastern limits of range unknown.

Characters.—Similar in color and size to *volans;* upperparts slightly more ochraceous; toes without conspicuous white markings; skull decidedly shorter and broader. Compared with *querceti:* Similar in color, but skull shorter, with smaller bullæ. Compared with *saturatus:* Colors much paler; skull shorter and broader.

Color.—Winter pelage (March): Upperparts yellowish wood brown to drab, shaded on sides and fore legs with pinkish buff; upper surface of flying membrane fuscous-black; ears fuscous; front feet

[1] Collection Mus. Comp. Zool.
[2] Three in collection Amer. Mus. Nat. His.; two in Field Mus. Nat. Hist.
[3] Collection Amer. Mus. Nat. Hist.
[4] Four in collection Amer. Mus. Nat. Hist.; three in Acad. Nat. Sci. Philadelphia.
[5] Collection Field Mus. Nat. Hist.
[6] Collection Mus. Vert. Zool., Univ. California.

buffy white; hind feet hair-brown or drab, the toes washed with buffy white; tail above, fuscous, shaded with snuff brown; beneath, light pinkish cinnamon; underparts creamy white. *Summer pelage:* A specimen from Colmesniel, Tex. (July 30), agrees essentially with the grayest April specimen from Sour Lake; a much worn specimen from Tarkington (November 23) is slightly more ochraceous than spring specimens.

Skull.—Similar to that of *saturatus*, but shorter and relatively broader; braincase more rounded, deeper, and more abruptly depressed posteriorly. Differs from *querceti* in the same characters and also in having smaller audital bullæ.

Measurements.—Average of 6 topotypes (adult): Total length, 229 (219–236); tail vertebræ, 104 (97–111); hind foot, 30.8 (30–31). *Skull:* Average of 5 topotypes (adult): Greatest length, 33.5 (32.7–34); zygomatic breadth, 20.9 (20.6–21.1); mastoidal breadth, 17.2 (17.1–17.4); least interorbital breadth, 7.2 (6.9–7.3); least postorbital breadth, 8.6 (8.2–8.9); length of nasals, 9.4 (9.2–9.8); maxillary toothrow, 6.3 (6.1–6.4).

Type specimen.—No. 136400, U. S. Nat. Mus. (Biological Survey collection); ♂ ad., skin and skull; collected March 15, 1905, by J. H. Gaut.

Remarks.—The Texas flying squirrel closely resembles both *volans* and *querceti* in color, but differs from them in skull characters. It is much paler than *saturatus*, which occupies the eastern Gulf States from Louisiana to Georgia. The material at hand is too scanty to show clearly the relationships and exact range of this form. Intergradation with *volans* is indicated by an intermediate specimen from Gainesville, Tex. (referred to *volans*), and doubtless intergradation takes place also with *saturatus* where their ranges meet.

Specimens examined.—Total number, 10, as follows:

Texas: Colmesniel, 1; Sour Lake, 6; Tarkington, 1; Texarkana, 1; Troup, 1.

GLAUCOMYS VOLANS GOLDMANI (Nelson).

MEXICAN FLYING SQUIRREL.

[Pl. II, fig. 6; Pl. IV, fig. 6.]

Sciuropterus volans goldmani Nelson, Proc. Biol. Soc. Washington, XVII, p. 148, Oct. 6, 1904.

Type locality.—Teopisca, Chiapas, Mexico (20 miles southeast).

Distribution.—Known only from type locality—probably the highlands of Chiapas and Guatemala.

Characters.—Closely similar in color to *saturatus*, but top and sides of nose whitish, sides of face marked with fuscous, and upper surface of flying membrane more brownish; soles naked; skull essentially like that of *volans*.

Color.—Spring pelage (April specimen, worn on nape and tail only): Upperparts dark sayal brown; sides of face smoke gray, strongly varied with fuscous; eye-ring fuscous; ears flesh color, shaded with fuscous; top and sides of nose creamy white; upper surface of flying membrane clove brown; hind feet fuscous, the toes faintly shaded with buff; front feet buffy white; tail, above, snuff brown; beneath, pinkish cinnamon or pale cinnamon buff; underparts creamy white, irregularly washed with pinkish cinnamon, most strongly along edges of membranes.

Skull.—Essentially the same as that of *volans*—slightly larger than that of *saturatus*.

Measurements.—Type and topotype: Total length, 237, 238; tail vertebræ, 112, 107; hind foot, 30, 31.5. *Skull:* Greatest length, 35.1, 34.9; zygomatic breadth, 21.3, 21.9; mastoidal breadth, 17.8, 17.5; least interorbital breadth, 8.7, 9.2; least postorbital breadth, 8.7, 9.2; length of nasals, 10.3, 9.9; maxillary toothrow, 6.4, 6.3.

Type specimen.—No. 132833, U. S. Nat. Mus. (Biological Survey collection); ♂ ad., skin and skull; collected April 8, 1904, by E. A. Goldman.

Remarks.—This race, although widely separated geographically from the United States forms of the group, bears so close a resemblance to *saturatus* that a subspecific designation seems best to express its relationship. From no point between southern Texas and Chiapas are specimens of the genus known, and Nelson and Goldman in their travels in Mexico heard of flying squirrels in only a few localities. The animals were reported to occur in the Pinal de Amoles range of mountains in eastern Queretaro, but whether these are referable to this race is unknown. Tomes, under the name *Pteromys volucella*, records a specimen from Duenas, Guatemala, which undoubtedly is referable to the present form.[1]

Specimens examined.—Two, from type locality.

Glaucomys sabrinus Group.

GLAUCOMYS SABRINUS (Shaw).

[Synonymy under subspecies.]

General characters.—Size medium to large (hind foot 34 mm. or more); hairs on underparts plumbeous at roots.

Cranial characters.—Skull medium to large (greatest length 36 mm. or more); rostrum usually rather long (except in *macrotis*); audital bullæ moderately or in some races considerably inflated.

Color.—Upperparts cinnamon, pinkish cinnamon, vinaceous-cinnamon, vinaceous-fawn, cinnamon-buff, avellaneous, drab, cinnamon-drab, wood brown, sayal brown, snuff brown, mikado brown, or pecan

[1] Tomes, Robert F., Proc. Zool. Soc. London, 1861, p. 281.

brown; sides (and in some races front) of face smoke gray or pale gray, often washed with buff, cinnamon, or fuscous; eye-ring fuscous; borders of flying membrane above, clove brown, fuscous, or blackish

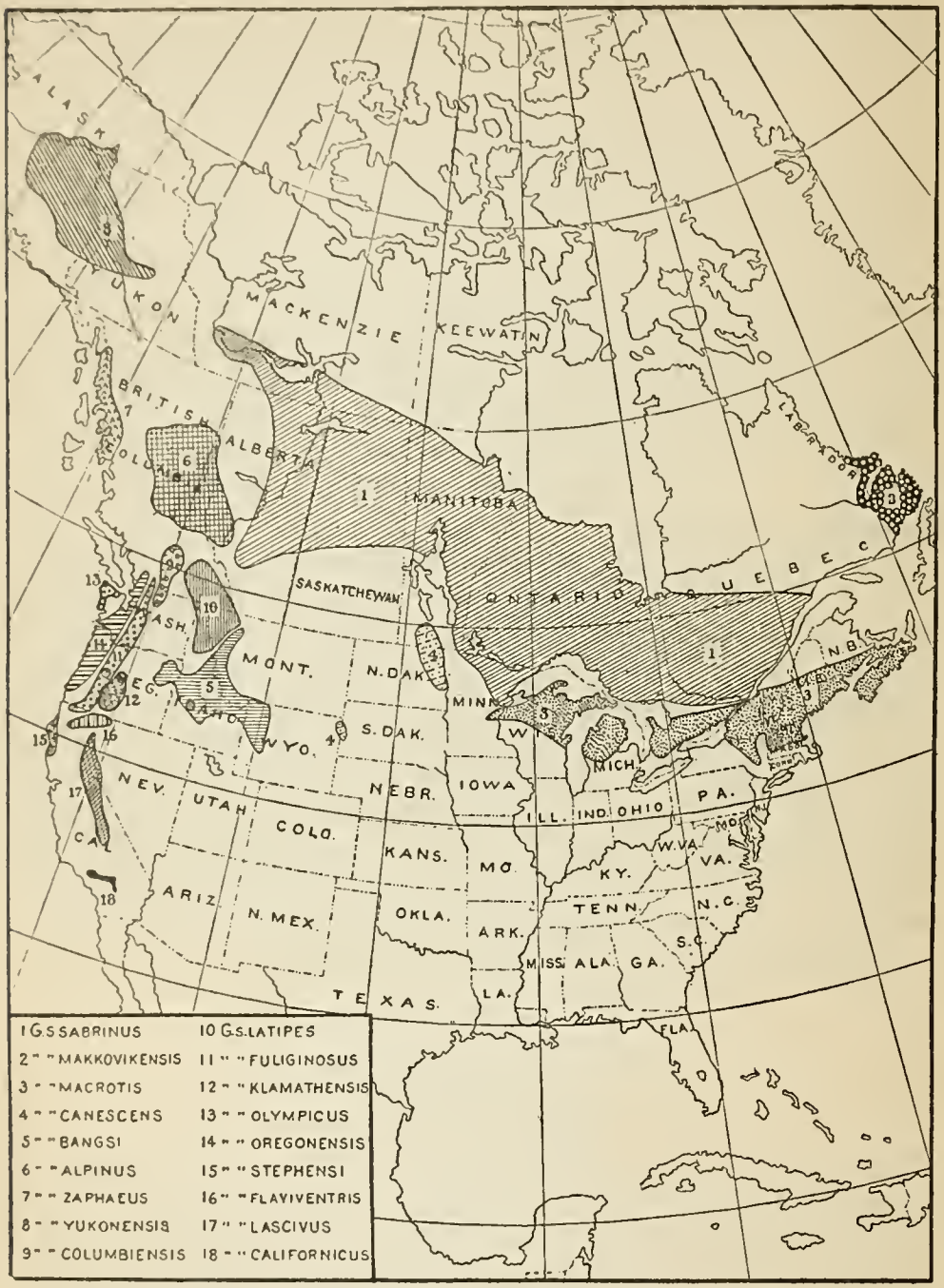

FIG. 3.—Map showing the distribution of the subspecies of *Glaucomys sabrinus* (except *G. s. bullatus*, see fig. 4, p. 51), based on specimens examined.

brown; forefeet hair-brown, wood brown, drab, or mouse gray; hind feet hair-brown, fuscous, clove brown, wood brown, snuff brown, or mouse gray, the soles buffy white, yellowish white, creamy white,

drab, mouse gray, cinnamon-buff, colonial buff, olive-ochre, olive-buff, or oil yellow; tail above, cinnamon, hair-brown, wood brown, sayal brown, snuff brown, clove brown, fuscous, or fuscous-black, usually darkest at the tip; tail beneath, pinkish cinnamon, vinaceous-cinnamon, pinkish-, ochraceous-, cinnamon-, colonial-, cream-, or olive-buff, drab, drab-gray, wood brown, avellaneous, clove brown, or fuscous-black, frequently edged with hair-brown or fuscous; underparts white, creamy white, or buffy white, more or less washed or clouded with pinkish cinnamon, pinkish-, ochraceous-, cream-, cinnamon-, colonial-, or cartridge-buff, straw yellow, greenish yellow, Naples yellow, wood brown, or avellaneous.

Geographic distribution.—Wooded parts of Alaska, Canada, northeastern United States, and mountains of western United States, from the Yukon Valley, Cook Inlet, Upper Mackenzie River, Fort Anderson, Great Slave Lake, northern Manitoba, northern Quebec (Hamilton River), and Labrador (Makkovik), south to northern Massachusetts, southern New York (Catskill Mountains), Pennsylvania (Erie ?), central Michigan (Montcalm County), northern Wisconsin, central Minnesota (Elk River), South Dakota (Black Hills), Utah (Uinta[1] and Wasatch Mountains[2]), Idaho (Sawtooth Mountains), and southern California (Sierra Nevada, San Bernardino, and San Jacinto Mountains) (figs. 3 and 4).

GLAUCOMYS SABRINUS SABRINUS (Shaw).

Hudson Bay Flying Squirrel.

[Pl. II, fig. 11; Pl. IV, fig. 11; Pl. VI, fig. 6; Pl. VII, fig. 10.]

Sciurus hudsonius Gmelin, Syst. Nat., I, p. 153, 1788 (not *Sciurus vulgaris hudsonicus* Erxleben, 1777).

Sciurus sabrinus Shaw, Gen. Zool., II, p. 157, 1801.

? *Pteromys canadensis* Geoffroy, Cat. Mamm. Mus. Hist. Nat., Paris, p. 170, 1803. Type locality, North America [probably Quebec, Canada.[3]]

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[1] Allen (Monogr. North Amer. Rodentia, p. 664, 1877) records a specimen from Uinta Mountains which has since disappeared from the collection; this specimen was taken September 20, 1870, by H. D. Schmidt, near the head of Smiths Fork, Utah (see Prelim. Rept. U. S. Geol. Surv. Wyoming, etc., pp. 41–44, 461, 1871).

[2] F. E. Crandall, of Victor, Idaho, states that while living in Emery County, Utah, he often saw flying squirrels and knew of their being killed by loggers when felling trees. His report indicates that some form of the group ranges much farther south than has been supposed.

[3] The description under this name was based on a specimen (No. CCCLI) in the Paris Museum, but as I am informed by Dr. A. Menegaux in a recent letter, this specimen is not now in the museum. The description is inadequate, but the size of the animal is given as 150 mm. This measurement probably refers to the length of head and body, and if so agrees well with that of certain specimens of *sabrinus* from southern Ontario. It is too large for any member of the *volans* group. The specimen doubtless was sent from Canada (probably from the vicinity of Quebec), as suggested by the common name, "Le Polatouche du Canada," and the name *canadensis* may thus be considered a synonym of *sabrinus* of two years earlier date.

Pteromys sabrinus Richardson, Zool. Journal, III, p. 519, 1828; Fauna Boreali-Amer., I, p. 193, 1829; Audubon and Bachman, Quad. North Amer., III, p. 202, 1853, plate CXLIII.

Pteromys hudsonius Fischer, Synop. Mamm., p. 365, 1829; Baird, Mamm. North Amer.: Rept. Expl. and Surv. R. R. Pac., VIII, p. 288, 1857.

Sciuropterus volucella var. *hudsonius* Allen, Proc. Boston Soc. Nat. Hist., XVI, p. 289, 1874; Allen, Monogr. North Amer. Rodentia: Rept. U. S. Geol. Surv. Terr., XI, p. 655, 1877.

Sciuropterus volucella sabrinus Rhoads, Amer. Nat., XXVIII, p. 525, 1894.

Sciuropterus sabrinus Bangs, Proc. Biol. Soc. Washington, X, p. 162, 1896.

Type locality.—Mouth of Severn River, Ontario, Canada.

Distribution.—Interior of Canada, from Fort Simpson (possibly Fort Anderson), Mackenzie, and lower Churchill River, west side of Hudson Bay, south to northern Minnesota, extreme northwestern Wisconsin, southern Ontario (vicinity of Lake Nipissing), and southern Quebec (Lake Edward).

Characters.—Size medium (for the group); general tone of upperparts vinaceous-cinnamon; sides of face smoke gray; tail strongly shaded with fuscous; underparts whitish, shaded with drab; skull of medium size, rather long and narrow, with narrow braincase.

Color.—*Winter pelage:* Upperparts deep vinaceous-cinnamon, the sides faintly washed with light pinkish cinnamon, the underfur dark mouse gray; upper surface of flying membrane fuscous, the color extending over legs and becoming paler on feet; toes shaded with grayish white; front and sides of face smoke gray or pale smoke gray; eye-ring fuscous; underparts soiled whitish, faintly washed with pale yellowish and more or less strongly shaded with drab or hair-brown, especially along sides, the underfur deep neutral gray; tail, above, hair-brown or fuscous, often shaded near the base with vinaceous-cinnamon, the tip usually clear fuscous; beneath, drab, shaded with pale wood brown and bordered on sides and tip with hair-brown or fuscous; soles buffy white on inner side, drab on outer side. *Summer pelage:* Similar to the winter pelage.

Skull.—Size medium (larger than *macrotis*, smaller than *alpinus*); braincase rather narrow and elongate; zygomata not widely expanded, contracted anteriorly; dorsal outline nearly straight from nasals to postfrontal region; braincase moderately depressed; audital bullæ of medium size.

Measurements.—Adult male from Cochrane, Ontario: Total length, 315; tail vertebræ, 140; hind foot (dry), 40; ear from notch (dry), 18. Adult female from Lake Edward, Quebec: 315; 148; 43; 20.5. Average of 4 adults from Norway House, Manitoba: Hind foot (dry), 39.5 (38.5–41). *Skull:* Subadult male from Cochrane, Ontario: Greatest length, 40; zygomatic breadth, 24; mastoidal breadth, 18.1; least interorbital breadth, 7.3; least postorbital breadth, 8.9; length of nasals, 11.5; maxillary toothrow, 7.8. Two adults

from vicinity of Great Slave Lake, Mackenzie: Greatest length, 39.9, 40.2; zygomatic breadth, 24.5, 24.4; mastoidal breadth, 18.8, 19.2; least interorbital breadth, 8.3, 8.2; least postorbital breadth, 9.4, 9.2; length of nasals, 12, 12.8; maxillary toothrow, 7.8, 8.1.

Type specimen.—Not now known to exist.[1]

Remarks.—The Hudson Bay flying squirrel—the first form of the group to receive a name—is still imperfectly known, no specimens from the type locality being as yet available. A good series of skins from Norway House, Manitoba, doubtless represent the typical form, and these have been used in making comparisons, but there are no skulls in any collection from nearer the type locality than Great Slave Lake on one side and Cochrane, Ontario, on the other. Since these skulls, however, agree essentially in characters, they are assumed to be typical. Two winter specimens from Cochrane, Ontario, differ from Norway House specimens in being slightly paler and less vinaceous above, having the hind feet mouse gray and the tail dark hair-brown, with scarcely a trace of vinaceous; whether these specimens represent the typical race or an unrecognized form can not now be decided.

The present race has a very wide range and apparently intergrades with all the surrounding forms—with *makkovikensis* in eastern Quebec, with *macrotis* in northern Minnesota, northern Wisconsin, northern Michigan, and southern Ontario; with *canescens* in southern Manitoba, with *alpinus* in southern Mackenzie and Alberta, and probably with *bangsi* in southwestern Alberta and northwestern Montana. Specimens showing intergradation with *alpinus* have been examined from Fort Providence and Fort Simpson, Mackenzie; and from Cascade Rapid, Grand Rapids, Edmonton, and Red Deer, Alberta. The northern specimens differ from typical *sabrinus* in being paler and grayer;[2] those from Red Deer are nearly typical in color, but have skulls closely resembling those of *alpinus*. Specimens from Trout Creek, Ontario; Hinckley and Itasca County, Minn.; and Gordon, Wis., are intermediate between *sabrinus* and *macrotis*. A specimen from Godbout, Quebec, agrees with *sabrinus* in color, but has a skull equaling that of *makkovikensis* in size. Specimens from Rat Portage, Ontario, and Winnipeg, Manitoba, are paler than the typical form, thus showing approach to *canescens*.

A specimen in worn and faded pelage, without tail or skull, from Fort Liard, Mackenzie, is provisionally referred to this race. Better material from that region may show the form occurring there to be *alpinus*.

[1] The names *hudsonius* and *sabrinus* were based on Forster's account (Philos. Trans., LXII, p. 379, 1772) of a specimen sent to the Royal Society from the mouth of Severn River.

[2] Some of these intermediates bear a surprisingly close resemblance in color to *bangsi*.

Specimens examined.—Total number, 72, as follows:

Alberta: Calgary, 1; Cascade Rapid, Athabaska River, 1; Didsbury, 1; Edmonton, 4;[1] Grand Rapids, Athabaska River, 1; Gull Lake, 1;[2] Red Deer, 2.[3]

Mackenzie: Big Island, Great Slave Lake, 3; Fort Anderson, 1;[3] Fort Liard, 1;[4] Fort Providence, 5;[5] Fort Resolution, 1;[6] Fort Simpson, 2; Hay River, Great Slave Lake, 2.

Manitoba: "Hudson Bay," 1; Norway House, 9; Oxford House, 1; Red River Settlement, 3; Selkirk Settlement, 1; Winnipeg, 2.

Minnesota: Hinckley, 2; Itasca County, 8.[7]

Ontario: Cochrane, 2;[5, 9] Hannah Bay (near Moose Factory), 1;[2] Matawagamingue [=Ft. Mattagami], 5; Moose Factory, 1;[2] Rat Portage, 1; Trout Creek, 2.[8]

Quebec: Godbout, 2; Lake Edward, 1;[10] Tadousac, 1.[6]

Saskatchewan: Cumberland House, 1.

Wisconsin: Gordon, 1;[7] Nemakagan River, Burnett County, 1.[11]

GLAUCOMYS SABRINUS MAKKOVIKENSIS (Sornborger).

Labrador Flying Squirrel.

[Pl. II, fig. 12; Pl. IV, fig. 12.]

Sciuropterus sabrinus makkovikensis Sornborger, Ottawa Nat., XIV, p. 48, June 6, 1900.

Type locality.—Makkovik, Labrador.

Distribution.—Coast region of Labrador and eastern Quebec; exact limits unknown.

Characters.—Similar to *sabrinus*, but larger and darker, with darker face, tail, and feet.

Color.—Adults: Upperparts dark vinaceous-cinnamon (averaging a shade darker than in *sabrinus*); sides of face smoke gray; upper surface of flying membrane clove brown; feet clove brown to fuscous, the soles buffy white and toes washed with the same color; tail fuscous-black or clove brown, both above and below, moderately mixed (chiefly near the base) with pinkish cinnamon; underparts soiled whitish, faintly washed with light pinkish cinnamon or pinkish buff. *Young:* Upperparts wood brown, shaded with vinaceous-cinnamon; tail nearly uniform fuscous-black.

Skull.—Similar to that of *sabrinus*, but slightly larger.

Measurements.—Average of 5 specimens (adult and subadult) from Labrador: Total length, 309 (293–330); tail vertebræ, 138

[1] Collection Victoria Mem. Mus.
[2] Collection Mus. Comp. Zool.
[3] Fragments of skeleton; provisionally referred.
[4] Provisionally referred.
[5] Three in collection Victoria Mem. Mus.
[6] Collection Amer. Mus. Nat. Hist.
[7] Collection Dr. H. V. Ogden, Milwaukee, Wis.
[8] Collection Carnegie Museum.
[9] Collection W. E. Saunders, London, Ont.
[10] Collection Field. Mus. Nat. Hist.
[11] Collection Milwaukee Pub. Mus.

(128–146); hind foot, 41.8 (40–45). *Skull:* Average of 6 adults from Labrador: Greatest length, 40.7 (40.4–41.3); zygomatic breadth, 24.5 (23.5–25.2); mastoidal breadth, 18.9 (18.6–19.1); least interorbital breadth, 7.8 (7.3–8.2); least postorbital breadth, 10 (9.7–10.3); length of nasals, 11.4 (10.7–12.2); maxillary toothrow, 7.8 (7.3–8.1).

Type specimens.—Cotypes, Nos. 10476, 10477, Mus. Comp. Zool. (formerly Nos. 1540, 1541, collection J. D. Sornborger); skins and skulls, the skulls imperfect; collected in 1899 by Rev. W. W. Perritt.

Remarks.—The Labrador flying squirrel, like certain other species from this region, is larger and darker than the form from the interior of Canada. It is very much larger than *macrotis*, of New England. Intergradation with *sabrinus* apparently takes place in the vicinity of Godbout, Quebec. There is no material to show what form occupies the interior of eastern Quebec.

Specimens examined.—Total number, 15, as follows:

Labrador: Cartwright, 1; L'Anse au Loup, 1;[1] Makkovik, 9;[1] Paradise, 3.
Quebec: Northwest River, 1.

GLAUCOMYS SABRINUS MACROTIS (MEARNS).

MEARNS FLYING SQUIRREL.

[Pl. II, fig. 10; Pl. IV, fig. 10; Pl. VI, fig. 5.]

Sciuropterus volucella hudsonius Merriam, Trans. Linn. Soc. New York, II, p. 108, 1884 (not *Sciurus hudsonius* Gmelin).

Sciuropterus sabrinus macrotis Mearns, Proc. U. S. Nat. Mus., XXI, p. 353, Nov. 4, 1898.

Type locality.—Hunter Mountain (Catskills), Greene County, New York; altitude 3,300 feet.

Distribution.—Nova Scotia, New Brunswick, Maine, New Hampshire, Vermont, northern Massachusetts, Boreal portions of New York, northern Pennsylvania (?), southern Ontario, northern part of Michigan, and northeastern Wisconsin; west to Elk River, Minnesota.

Characters.—Similar to *sabrinus*, but smaller; ears averaging slightly longer; upperparts and hind feet paler and underparts whiter.

Color.—Winter pelage (adult): Upperparts cinnamon or pinkish cinnamon (rarely light pinkish cinnamon), shading on sides to pinkish buff; sides of face pale smoke gray, this color extending back on sides of neck beyond the ears; top of nose frequently tinged with gray; upper surface of membranes clove brown; fore feet drab, clouded with dull white; hind feet, above, light hair-brown or mouse gray; beneath, soiled whitish, shaded with drab or buff; tail, above, dull cinnamon, more or less mixed with hair-brown or fuscous, the general tone varying from hair-brown to pale snuff brown; beneath,

[1] Collection Mus. Comp. Zool.

pinkish cinnamon or light pinkish cinnamon; underparts white, irregularly shaded with light pinkish cinnamon. *Summer pelage:* Similar to the winter pelage, but upperparts usually slightly darker—pale orange-cinnamon. *Young* (October): Upperparts between wood brown and fawn color, otherwise as in adult.

Skull.—Similar to that of *sabrinus*, but decidedly smaller; braincase less elongate, more nearly spherical. Compared with *G. volans volans:* Slightly larger (greatest length 36 mm. or more in *macrotis;* 35.6 mm. or less in *volans*); fronto-parietal region more elevated; braincase deeper and less flattened.

Measurements.—Average of 16 adults from New York and New England:[1] Total length, 275.6 (263–290); tail vertebræ, 126.4 (115–135); hind foot, 36 (34–38); ear from notch (dry),[2] 18.8 (16–20). *Skull:* Average of 11 adults from same region: Greatest length, 37.3 (36–38.7); zygomatic breadth, 22.6 (21.9–23.5); mastoidal breadth, 17.6 (17.2–18); least interorbital breadth, 6.9 (6.2–7.3); least postorbital breadth, 9.2 (8.6–9.9); length of nasals, 10.7 (10–11.5); maxillary toothrow, 7 (6.4–7.7).

Type specimen.—No. 83152, U. S. Nat. Mus.; ♀ ad., skin and skull; collected August 31, 1896, by Edgar A. Mearns.

Remarks.—The Mearns flying squirrel is a strongly marked form having a rather extensive range in the Northeastern States and southern Canada, from Minnesota to Nova Scotia. It is not known from any point south of the Catskills in New York and the vicinity of Erie, Pa.,[3] but may be expected to occur in the mountainous parts of Pennsylvania and possibly farther south in the Alleghenies.

Intergradation with *sabrinus* is shown by specimens from southern Ontario (Gooderham) and northern Michigan (Porcupine Mountains and Vermilion). Two specimens from Elk River, Minn., show approach to *canescens*, one of them being almost as pale as that form. The skulls are nearly typical of *macrotis*. Specimens from Maine have somewhat shorter ears than those from New York, Massachusetts, and New Hampshire.

The range of this form overlaps that of *G. volans volans* for a considerable distance in southern New England, New York, Michigan, Wisconsin, and Minnesota. Although some specimens approach *volans* rather closely in size and resemble it in the shape of skull and shortness of rostrum, they are always readily separable (except, perhaps, in the young) from the latter species by the plumbeous bases of the hairs on the belly. The upperparts, also, are decidedly more vinaceous and less drab than in *volans*.

[1] Hunter Mountain and Peterboro, N. Y.; Wilmington, Mass.; Ossipee, N. H.; Greenville, Bucksport, and Moosehead Lake, Maine.

[2] Seven specimens from New York, Massachusetts, and New Hampshire.

[3] The specimens labeled as from Erie are without further data, but are said to have been in the collection of Geo. B. Sennett; they may not have been collected in the immediate vicinity of Erie. There are no other Pennsylvania records.

Specimens examined.—Total number, 78, as follows:

Maine: Bucksport, 3;[1] Greenville, 8;[1] Lincoln, 6;[2] Moosehead Lake, 1;[1] Steuben, 1; Third Mopang Lake, 2.[2]
Massachusetts: Lunenburg, 1; Wilmington, 3; Winchendon, 1.
Michigan: Le Roy, 1;[3] Montcalm County, 1;[3] Palmer, 1; Porcupine Mountains, 3;[3] Vermilion, 3.[3]
Minnesota: Elk River, 2.
New Brunswick: No specific locality, 1.
New Hampshire: Ossipee, 4.
New York: Adirondack Mountains, 1; Big Moose Lake, 3; Hunter Mountain, Greene County, 1; Locust Grove, 1; Peterboro, 1.
Nova Scotia: Annapolis, 3;[3, 4] Halifax, 3; Kings County, 5.[5]
Ontario: Gooderham, 3;[6] Maganetewan, 1;[2] New Edinburgh, 1;[5] Woodstock, 1.[7]
Pennsylvania: Erie [=mountains near?], 2.[8]
Vermont: Rutland, 2;[9] Sherburne, 1.[9]
Wisconsin: Clarks Lake, Door County, 1; Kelley Brook, 1;[10] Lakewood, 2; Langlade County, 1;[11] Mamie Lake, Vilas County, 2.

GLAUCOMYS SABRINUS CANESCENS Howell.

Pallid Flying Squirrel.

[Pl. II, fig. 7; Pl. IV, fig. 7; Pl. VI, fig. 11.]

Glaucomys sabrinus canescens Howell, Proc. Biol. Soc. Washington, XXVIII, p. 111, May 27, 1915.

Type locality.—Portage la Prairie, Manitoba.

Distribution.—Southern Manitoba; eastern North Dakota; Black Hills, S. Dak.; and Bear Lodge Mountains, Wyo.; exact limits unknown.

Characters.—Similar to *macrotis*, but much paler, with grayer head and larger skull. Compared with *sabrinus:* Size smaller; upperparts and feet paler; underparts whiter.

Color.—*Winter pelage:* Upperparts light pinkish cinnamon, shading to pale pinkish cinnamon on sides; front and sides of face (sometimes nearly the whole head) pale smoke gray; ears pale fuscous; eye-ring and upper side of flying membrane fuscous; feet hair-brown, the toes marked with grayish white; tail, above, dark cinnamon, shaded with hair-brown; beneath, light pinkish cinnamon, edged with hair-brown; underparts and soles creamy white.

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[1] Collection Mus. Comp. Zool.
[2] Collection Acad. Nat. Sci. Philadelphia.
[3] Collection Univ. Michigan.
[4] Collection E. R. Warren, Colorado Springs, Colo.
[5] Collection Victoria Mem. Mus.
[6] Collection Field Mus. Nat. Hist.
[7] Collection W. E. Saunders, London, Ont.
[8] Collection Amer. Mus. Nat. Hist.
[9] Collection G. L. Kirk, Rutland, Vt.
[10] Collection Milwaukee Pub. Mus.
[11] Collection Dr. H. V. Ogden, Milwaukee, Wis.

Skull.—Similar to that of *macrotis*, but slightly longer and relatively narrower, with longer nasals; decidedly smaller than that of *sabrinus*.

Measurements.—Average of 3 adults:[1] Total length, 297 (290–306); tail vertebræ, 138 (133–146); hind foot, 37.7 (37–38). *Skull:* Two topotypes (adult): Greatest length, 38.5, 38.8; zygomatic breadth, 22.8, 22.9; mastoidal breadth, 17.5, 17.6; least interorbital breadth, 9.2, 9.5; least postorbital breadth, 9.4, 9.2; length of nasals, 11.5, 11.2; maxillary toothrow, 7.7, 7.6.

Type specimen.—No. 7663, Field Mus. Nat. Hist.; ♀ subad., skin and skull; collected February 3, 1900, by G. F. Dippie.

Remarks.—This is the palest of the races of *sabrinus*, occupying chiefly the thinly timbered parts of southern Manitoba and eastern North Dakota. The limits of its range are not known, and may extend westward to Saskatchewan. Two specimens from the Bear Lodge Mountains, Wyo., are referred to this race, but a larger series may show characters to separate the form in that region. These two specimens show some approach to *bangsi* in skull characters and in a slightly more vinaceous coloring on the upperparts. One of them has a wash of pinkish cinnamon on the underparts. In a specimen from Portland, N. Dak., the upperparts are a deeper shade of pinkish cinnamon and the skull is larger, showing, apparently, intergradation with *sabrinus*. Two specimens in worn pelage from Pembina, N. Dak., are also considered intermediate between *canescens* and *sabrinus*.

Specimens examined.—Total number, 10, as follows:

Manitoba: Carberry, 1; Portage la Prairie, 2.[2]
Minnesota: Breckenridge, 1.
North Dakota: Grafton, 1; Pembina, 2; Portland, 1.
Wyoming: Bear Lodge Mountains (Middle Fork Hay Creek), 2.

GLAUCOMYS SABRINUS BANGSI (Rhoads).

Bangs Flying Squirrel.

[Pl. II, fig. 3; Pl. IV, fig. 3; Pl. VI, fig. 10.]

Sciuropterus alpinus bangsi Rhoads, Proc. Acad. Nat. Sci. Philadelphia, June, 1897, p. 321.

Type locality.—Idaho County, Idaho.

Distribution.—Mountains of central Idaho, eastern Oregon, southwestern Montana, and western Wyoming, north to vicinity of Flathead Lake, Montana; southern limits unknown.

Characters.—Similar in size and color to *sabrinus*, but upperparts averaging more drab (less vinaceous or ochraceous) and underparts more clouded with pinkish cinnamon (never yellowish white, as in

[1] Two from type locality; one from Portland, N. Dak.
[2] Collection Field Mus. Nat. Hist.

sabrinus); feet grayer (less brownish). Compared with *alpinus:* Upperparts decidedly more vinaceous, tail paler and much less clouded with fuscous.

Color.—Winter pelage: Upperparts pale wood brown or avellaneous, shading in some specimens to vinaceous-cinnamon; feet pale hair-brown, shading to drab-gray, the toes often grayish white; tail above, wood brown, tinged with cinnamon and more or less shaded with hair-brown or fuscous; beneath, light pinkish cinnamon, shaded with dark hair-brown; underparts whitish, strongly washed with pinkish cinnamon or avellaneous. *Variation* (May specimen from Lake Como, Mont.): Upperparts pale orange-cinnamon; feet pale fuscous.

Skull.—Very similar to that of *sabrinus;* slightly smaller than that of *alpinus*, with smaller bullæ.

Measurements.—Average of 6 (adult and subadult) from Idaho and Montana:[1] Total length, 315 (304–327); tail vertebræ, 142 (137–148); hind foot, 39.5 (37–41). *Skull:* Average of 7 (adult and subadult) from same localities: Greatest length, 39.9 (38.2–41.2); zygomatic breadth, 24.3 (23.3–25); mastoidal breadth, 18.7 (18.3–19.1); least interorbital breadth, 7.5 (6.9–8); least postorbital breadth, 9 (8.4–9.7); length of nasals, 12.2 (11.1–12.5); maxillary toothrow, 8.1 (7.6–8.7).

Type specimen.—No. 6959, Mus. Comp. Zool. (formerly same number, collection E. A. and O. Bangs); ♂ subad., skin and skull; collected March 8, 1897, by Harbison and Bargamin, Raymond, Idaho.

Remarks.—This subspecies is the smallest of the Rocky Mountain forms of *sabrinus.* It agrees with the typical race in skull characters, but shows some approach in color to *alpinus*, differing from the latter, however, in color of tail and skull characters. Intergradation with *sabrinus* is indicated by a specimen from Paola, Mont. With *latipes*, whose range meets (and possibly overlaps) that of *bangsi*, there seems to be no intergradation. The specimen from Paola shows no approach to *latipes*, while one from Nyack, a few miles farther north, is clearly referable to the latter form. Specimens from western Wyoming (Pahaska, Kendall, Pacific Creek) are slightly larger than typical specimens, but do not differ appreciably in color. An August specimen from Anthony, Oreg., provisionally referred to this race, has the upperparts rich orange-cinnamon, much darker than any of the Idaho series, and quite different from another August specimen from Bourne, Oreg., which is in the normal wood-brown phase.

Specimens examined.—Total number, 31, as follows:

Idaho: Idaho County, 2;[2] Ketchum, 2;[2] Sawtooth Lake, 2.

[1] Idaho County (type and topotype), Ketchum, and Sawtooth Lake, Idaho; Florence, Mont.

[2] Collection Mus. Comp. Zool.

Montana: Florence, 6; Paola, 1; Rock Creek, near Lake Como, 1.
Oregon: Anthony, 9;[1] Bourne, 1.
Wyoming: Kendall (12 miles north, at 7,700 feet altitude), 2; Pacific Creek, 1; Pahaska, 2; Wind River Mountains, near Dubois, 2.

GLAUCOMYS SABRINUS ALPINUS (Richardson).

Richardson Flying Squirrel.

[Pl. II, fig. 4; Pl. IV, fig. 4; Pl. VI, fig. 12.]

Pteromys alpinus Richardson, Zool. Journal, III, p. 519, 1828; Audubon and Bachman, Quad. North Amer., III, p. 206, 1854; Baird, Mamm. North Amer.: Rept. Expl. and Surv., R. R. Pac., VIII, p. 289, 1857.

Pteromys sabrinus var. *β alpinus* Richardson, Fauna Boreali-Amer., I, p. 195, 1829.

[*Sciuropterus volucella*] *alpinus* Trouessart, Bull. Soc. Angers, X, p. 67, 1880.

Sciuropterus alpinus Rhoads, Proc. Acad. Nat. Sci. Philadelphia, p. 319, 1897.

Type locality.—Jasper House, Alberta.[2]

Distribution.—Rocky Mountain region of Alberta and British Columbia, from vicinity of Henry House north at least to Peace River and Babine Lake, British Columbia (limits of range unknown).

Characters.—Similar to *sabrinus*, but upperparts much grayer (less vinaceous), tail darker, and skull larger, with broader braincase.

Color.—*Winter pelage:* Upperparts light drab; sides of face pale smoke gray; eye-ring fuscous; ears edged with blackish brown; upper surface of flying membrane blackish brown; hind feet hair-brown; fore feet similar but slightly paler; soles and palms soiled whitish; tail wood brown, much mixed, both above and below, with fuscous or clove brown, strongest on sides and tip; underparts soiled whitish, sometimes irregularly marked (chiefly along median line) with light pinkish cinnamon.

Skull.—Similar to that of *sabrinus*, but larger, with broader braincase; postorbital constriction relatively narrow.

Measurements.—Two adults from Henry House, Alberta: Total length, 292, 343; tail vertebræ, 123, 155; hind foot, 44.5, 43; average of 3 adults from Stuart Lake, B. C.: 322; 149; 41.7. *Skull:* Average of 3 adults from Henry House and Jasper House, Alberta: Greatest length, 41.5 (41.2–42); zygomatic breadth, 25.4 (25.1–25.6); mastoidal breadth, 19.4; least interorbital breadth, 8.3 (8.2–8.8); least postorbital breadth, 9.2 (9.1–9.6); length of nasals, 12.5 (12.4–12.6); maxillary toothrow, 7.8 (7.5–8.1).

[1] Seven in collection Amer. Mus. Nat. Hist.; two in Mus. Vert. Zool., Univ. California.

[2] The habitat is given by Richardson in the original description as "Vallies in the Rocky Mountains." Later (Fauna Boreali-Amer., I, p. 195, 1829) he speaks of specimens from the head of the Elk [=Athabaska] River, and from the south branch of the Mackenzie [=Liard, specimens probably from Fort Nelson]. As Richardson speaks of Drummond as the discoverer of the species, the vicinity of Jasper House, on the headwaters of the Athabaska, near which place Drummond made extensive collections, may be considered the type locality.

Type specimen.—None known to exist.

Remarks.—This handsome race, recognized as distinct by Richardson nearly a century ago, has until recently been imperfectly known. Baird, in 1857, admitted the species but was in doubt as to its real characters. Allen, in his Monograph of the Sciuridæ (1877) placed it in synonymy. Rhoads, in 1897,[1] restored it to specific rank, evidently using New England specimens of *macrotis* in comparison and considering them typical of *sabrinus*. Additional material now available, both of typical *alpinus* and of *sabrinus* from various parts of its range, shows conclusively that the two forms are subspecifically related. As already shown under *sabrinus* (p. 33), specimens from western Mackenzie and northern Alberta are intermediate in color between *alpinus* and *sabrinus* and those from southern Alberta have skulls nearly typical of *alpinus* but agree with *sabrinus* in color. Of two specimens from Peace River Canyon, B. C., one is typical of *alpinus*, while the other closely matches *sabrinus* in color. The present form intergrades, also, with *zaphœus* and *columbiensis* in British Columbia, and possibly with *bangsi* in southern Alberta. Several specimens from Stuart Lake, B. C., are intermediate in color between *alpinus* and *columbiensis*, while one specimen is so dark as to suggest intergradation with *zaphœus*.

Specimens examined.—Total number, 23, as follows:

Alberta: Henry House, 3; Jasper House, 2; no specific locality, 1.[2]
British Columbia: Babine Lake, 8; Cariboo, 1;[2] Peace River Canyon (near Hudsons Hope), 2; Stuart Lake, 6.[3]

GLAUCOMYS SABRINUS YUKONENSIS (Osgood).

Yukon Flying Squirrel.

[Pl. II, fig. 8; Pl. IV, fig. 8.]

Sciuropterus yukonensis Osgood, North Amer. Fauna No. 19, p. 25, Oct. 6, 1900.

Type locality.—Camp Davidson, Yukon River, Yukon (near Alaska-Canada boundary).

Distribution.—Yukon River region, from vicinity of Mayo Lake, Yukon (head of Stewart River), to Tanana, Alaska; exact limits unknown.

Characters.—Similar to *sabrinus* in color, but larger, with longer tail, broader hind foot, and larger skull. Compared with *alpinus:* Upperparts more ochraceous (less drab); tail longer and more vinaceous.

Color.—Upperparts pinkish cinnamon to vinaceous-cinnamon; sides of face pale smoke gray, sometimes clouded with light pinkish

[1] Proc. Acad. Nat. Sci. Philadelphia., 1897, p. 319.
[2] Collection Field Mus. Nat. Hist.
[3] Two in collection Provincial Mus., Victoria, B. C.; one in Acad. Nat. Sci. Philadelphia.

cinnamon; eye-ring clove brown or fuscous-black; upper surface of flying membrane clove brown or fuscous; legs similar, partially overlaid with the color of the back; feet wood brown, hair-brown, or mouse gray; soles and palms cinnamon-buff or whitish, clouded with mouse gray; tail above, sayal brown, shaded with fuscous, becoming pure fuscous at the tip; beneath, vinaceous-cinnamon or light pinkish cinnamon, edged with fuscous or hair-brown; underparts soiled whitish, moderately washed with light pinkish cinnamon or avellaneous.

Skull.—Closely similar to that of *alpinus;* braincase slightly larger; nasals slightly shorter.

Measurements.—Type: Total length, 365; tail vertebræ, 180;[1] hind foot (dry), 41; ♀ adult from Tanana, Alaska: 324; 150; 42. *Skull:* Average of 3 adults from Alaska:[2] Greatest length, 41.3 (41–41.5); zygomatic breadth, 25.2 (25.1–25.3); mastoidal breadth, 19.6 (19.5–19.7); least interorbital breadth, 8.1 (7.8–8.3); least postorbital breadth, 9.5 (9.3–10.3); length of nasals, 11.9 (11.6–12.1); maxillary toothrow, 8.3 (7.9–8.7).

Type specimen.—No. $\frac{19909}{35320}$, U. S. Nat. Mus.; ♀ ad., skin and skull; collected December 8, 1890, by R. E. Carson.

Remarks.—This is one of the larger members of the group, about equaling *latipes* and *bullatus* in external measurements. The hind feet, although about the same length as those of *alpinus*, are considerably broader and heavier, and the tail averages longer. Although the present form resembles *sabrinus* in color, its skull is practically identical with that of *alpinus*. No specimens are available from the large area between the known ranges of *alpinus* and *yukonensis*, but in view of the close relationship of these two forms, as shown by the skull characters, it seems probable that they will be found to intergrade, and for that reason *yukonensis* is here treated as a subspecies of *sabrinus*. Osgood states[3] that flying squirrels have been taken in the Knik district, Cook Inlet, but until specimens can be secured from that region their subspecific identity must remain in doubt.

Specimens examined.—Total number, 10, as follows:

Alaska: Big Chena River (65 miles from mouth), 1;[4] Chicken, 1; Tanana, 3; Toklat River (head), 1.

Yukon: Camp Davidson (near Alaska-Canada boundary), 2; Fortymile, 1;[5] Mayo Lake, 1.[6]

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[1] In a topotype, the tail (measured from dry skin) is approximately 160.

[2] Camp Davidson, Tanana, and head of Toklat River.

[3] Osgood, W. H., North Amer. Fauna No. 21, p. 63, 1901.

[4] Skull only.

[5] Collection Mus. Vert. Zool., Univ. California.

[6] Collection Victoria Mem. Mus.

GLAUCOMYS SABRINUS ZAPHÆUS (Osgood).

Alaska Coast Flying Squirrel.

[Pl. III, fig. 6; Pl. V, fig. 6; Pl. VI, fig. 9.]

Sciuropterus alpinus zaphæus Osgood, Proc. Biol. Soc. Washington, XVIII, p. 133, Apr. 18, 1905.

Type locality.—Helm Bay, Cleveland Peninsula, Alaska.

Distribution.—Coast region of southeastern Alaska and northern British Columbia; limits of range unknown.

Characters.—Similar to *alpinus*, but upperparts browner (less grayish) and underparts darker. Compared with *oregonensis*: Upperparts paler; underparts grayer (without cinnamon or buff).

Color.—*Winter pelage:* Upperparts sayal brown; sides of face pale smoke gray, often clouded with fuscous-black, the blackish eye-ring often pronounced; upper surface of flying membrane fuscous; feet dark hair-brown or fuscous, the soles whitish tinged with hair-brown on outer margin; tail above, fuscous, tinged with sayal brown; beneath, dull vinaceous-cinnamon, much clouded with fuscous on sides and tip; underparts soiled whitish, strongly washed with avellaneous or wood brown, strongest along sides. *Summer pelage:* Upperparts yellowish wood brown; underparts washed with pinkish cinnamon.

Skull.—Similar to that of *alpinus*, but braincase narrower, bullæ slightly smaller, and upper toothrow slightly longer.

Measurements.—Average of 6 topotypes (adult): Total length, 307 (292–311); tail vertebræ, 144 (133–152); hind foot (dry skin), 40.7 (39–42); average of 3 topotypes (adult):[1] 306; 145; 40. *Skull:* Average of 6 topotypes (adult and subadult): Greatest length, 40.1 (39.3–41.5); zygomatic breadth, 24.7 (23.7–26.2); mastoidal breadth, 18.7 (18.2–19.1); least interorbital breadth, 7.8 (7.4–8.3); least post-orbital breadth, 9 (8.7–9.8); length of nasals, 12.5 (12.2–12.9); maxillary toothrow, 7.8 (8–8.6).

Type specimen.—No. 136137, U. S. Nat. Mus. (Biological Survey collection); ♀ ad., skin and skull; collected January 21, 1905, by Cyrus Catt.

Remarks.—This subspecies is intermediate in color between *alpinus* and *oregonensis*, being nearer the latter in the color of the upperparts, but lacking the deep cinnamon-buff on the underparts. In skull characters it is close to *alpinus* and intergrades with it in the interior of British Columbia. The northern and southern limits of its range are unknown, but very probably it intergrades with *oregonensis* in southwestern British Columbia and possibly with *yukonensis* in Yukon.

[1] Measured in flesh by Frank Stephens.

Specimens examined.—Total number, 14, as follows:

Alaska: Bradfield Canal, 1;[1] Etolin Island, 1;[1] Helm Bay, Cleveland Peninsula, 10;[2] Tongass, 1.

British Columbia: Nass River, 1.

GLAUCOMYS SABRINUS OREGONENSIS (BACHMAN).

BACHMAN FLYING SQUIRREL.

[Pl. III, fig. 11; Pl. V, fig. 11; Pl. VI, fig. 8.]

Pteromys oregonensis Bachman, Journ. Acad. Nat. Sci. Philadelphia, VIII, p. 101, 1839; Audubon and Bachman, Quad. North Amer., I, p. 132, 1846.

[*Sciuropterus volucella*] *oregonentis* [sic] Trouessart, Bull. Soc. Angers, X, p. 67, 1880.

Sciuropterus alpinus oregonensis Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 1897, p. 324.

Type locality.—"Pine woods of the Columbia near the sea"—probably near the present site of St. Helens, Oregon.

Distribution.—Coast region of Oregon, Washington, and southern British Columbia; northern and southern limits unknown.

Characters.—Similar to *zaphœus*, but colors more rufescent, both above and below (upperparts rich reddish brown, underparts cinnamon or buff); sides of face more buffy (less grayish); skull slightly smaller.

Color.—*Winter pelage:* Upperparts mikado brown or pecan brown; sides of face smoke gray or grayish white, often much mixed with buff or cinnamon; upper surface of flying membrane clove brown or fuscous; hind feet snuff brown or pale fuscous, the soles pinkish buff shaded with drab; fore feet hair-brown or drab; tail above, snuff brown, shaded on sides and tip with fuscous or clove brown; beneath, cinnamon-buff; underparts heavily washed with pinkish cinnamon or cinnamon-buff.

Skull.—Similar to that of *zaphœus*, but averaging smaller, with the zygomata less widely expanded. Closely similar to that of *fuliginosus*, but averaging slightly smaller.

Measurements.—Average of 4 adults from Oregon:[3] Total length, 300 (294–310); tail vertebræ, 127 (122–138); hind foot, 38.6 (38–40). *Skull:* Average of 8 adults from Oregon:[4] Greatest length, 39.9 (38.5–40.7); zygomatic breadth, 23.7 (23–24.9); mastoidal breadth, 18.3 (17.6–19); least interorbital breadth, 7.9 (7.3–8.8); least postorbital breadth, 8.6 (8.1–9); length of nasals, 12.2 (10.9–12.9); maxillary toothrow, 8.2 (7.9–8.7).

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[1] Collection Mus. Vert. Zool., Univ. California.

[2] Four in collection Mus. Vert. Zool., Univ. California.

[3] Portland, Yaquina Bay, and Gold Beach.

[4] Portland (3), Latourelle Falls, Yaquina Bay, Gold-Beach, Salem, and lower Columbia River (type).

Type specimen.—No. 235, Acad. Nat. Sci. Philadelphia; adult, skin and skull; skin (dismounted and skull removed) in fair condition, possibly somewhat faded; skull nearly perfect, but portion of occiput cut away; collected in 1839 by J. K. Townsend.

Remarks.—The Bachman flying squirrel is easily recognized by its rich coloration, rufescent above and buffy below. It occupies the humid northwest coast belt, but does not range high in the mountains. Intergradation with *fuliginosus* is shown by a specimen from Marmot, Oreg. (west slope of Mount Hood), and with *columbiensis* by specimens from Sumas, Chilliwack, and Stave Lake, B. C. These latter specimens agree with *oregonensis* in the color of the upperparts, but are much paler beneath. A specimen from Sulphur Springs, Oreg., is considerably paler above than typical specimens. Specimens from Yaquina Bay and Gold Beach, Oreg., have smaller skulls than the type and other specimens from the Columbia River.

Specimens examined.—Total number, 41, as follows:

British Columbia: Agassiz, 1;[1] Chilliwack, 1; Harrison, 1;[2] Mission, 1;[3] Stave Lake, 1;[4] Sumas, 3.[4]

Oregon: Brownsville, 1;[5] Clackamas River, 1; "Columbia River," 3;[6] Elk Head, 1; Gold Beach, 1; Latourelle Falls (18 miles east of Portland), 1;[7] Marmot, 1; Portland, 4; Port Orford, 4; Salem, 1;[7] Sulphur Springs, Benton County (near Albany), 1; Yaquina Bay, 1; no specific locality, 2.

Washington: Camp Skagit, 1; Fort Bellingham, 1; "Lewis River," 1;[4] Olympic Mountains (north Fork Skokomish River), 1; Puget Sound. 6; no specific locality, 1.

GLAUCOMYS SABRINUS COLUMBIENSIS Howell.

Okanagan Flying Squirrel.

[Pl. III, fig. 7; Pl. V, fig. 7; Pl. VI, fig. 7.]

Glaucomys sabrinus columbiensis Howell, Proc. Biol. Soc. Washington, XXVIII, p. 111, May 27, 1915.

Type locality.—Okanogan, British Columbia.

Distribution.—Interior valleys and foothills of southern British Columbia and northern Washington, from Shuswap Lake and Cranbrook, British Columbia, south to Lake Chelan, Washington.

Characters.—Decidedly paler than *oregonensis*, both above and below; similar to *klamathensis*, but upperparts more vinaceous and tail much darker; very similar to *sabrinus*, but soles of hind feet often yellow (as in *klamathensis*), and skull larger. Compared with

[1] Collection W. E. Saunders, London, Ont.
[2] Collection Provincial Mus., Victoria, B. C.
[3] Collection Victoria Mem. Mus.
[4] Collection Mus. Comp. Zool.
[5] Collection Leland Stanford, Jr., Univ.
[6] Collection Acad. Nat. Sci. Philadelphia.
[7] Collection Game Dept. Oregon.

fuliginosus: Upperparts more vinaceous (less brownish); underparts paler; tail more brownish.

Color.—Winter pelage: Upperparts between vinaceous-cinnamon and vinaceous-fawn; sides of face smoke gray, shaded with fuscous; front of face sometimes marked with grayish white; upper surface of flying membrane clove brown; feet hair-brown or pale fuscous, the soles deep colonial buff, or sometimes grayish white; tail above, snuff brown, shading to fuscous on sides and tip; beneath, pinkish cinnamon, more or less clouded (often strongly) with fuscous; underparts white, tinged with straw yellow or light pinkish cinnamon.

Skull.—Closely similar to that of *alpinus*, but averaging slightly narrower, with flatter, shallower braincase; similar to that of *oregonensis*, but slightly larger, with shorter toothrow; very similar to that of *fuliginosus*, but averaging relatively broader.

Measurements.—Two topotypes (subadult): Total length, 313; tail vertebræ, 143; hind foot, 42. *Skull:* Average of 7 (adult and subadult) from southern British Columbia.[1] Greatest length, 41.1 (40.3–41.6); zygomatic breadth, 24.5 (23.6–25.2); mastoidal breadth, 19.1 (18.8–19.5); least interorbital breadth, 7.8 (7.3–8.6); least postorbital breadth, 9.1 (8.4–9.7); length of nasals, 12.6 (12–13.3); maxillary toothrow, 7.8 (7.6–8.2).

Type specimen.—No. 94310, U. S. Nat. Mus. (Biological Survey collection); ♂ subad., skin and skull; collected May 9, 1898, by Allan Brooks.

Remarks.—This subspecies, like most of the races inhabiting the dry interior valleys of southern British Columbia, is considerably paler than the coast form (*oregonensis*). Intergradation with the latter is shown by a series of specimens from Sumas and Chilliwack, B. C., and with *fuliginosus* by a series from mouth of Salmon River, B. C. Two specimens in the latter series are referable to the present form, although having somewhat darker underparts. Other specimens, labeled as from the same locality but possibly taken at a higher altitude, agree essentially with *fuliginosus*, to which race they are referred. Intergradation with *alpinus* is shown by specimens from Stuart Lake, B. C. (referred to *alpinus*). One specimen from Cranbrook, B. C., is considerably grayer above than the typical form, thus suggesting intergradation with *latipes*, with which it agrees in all other respects. Another from the same place is typical.

Specimens examined.—Total number, 11, as follows:

British Columbia: Cranbrook, 2; Grand Prairie (22 miles northwest of Okanogan), 1;[2] Okanogan, 2; (Okanogan Falls (Shuttleworth Creek), 1;[2] Penticton, 1;[3] Salmon River (mouth), 2;[3] Vernon, 1.

Washington: Chelan Mountains, 1.[4]

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[1] Okanogan, Vernon, Penticton, Cranbrook, and mouth of Salmon River.

[2] Collection Provincial Mus., Victoria, B. C.

[3] Collection Victoria Mem. Mus.

[4] Collection Amer. Mus. Nat. Hist.

GLAUCOMYS SABRINUS FULIGINOSUS (Rhoads).

Cascade Flying Squirrel.

[Pl. III, fig. 4; Pl. V, fig. 4; Pl. VII, fig. 7.]

Sciuropterus alpinus fuliginosus Rhoads, Proc. Acad. Nat. Sci. Philadelphia, June, 1897, p. 321.

Type locality.—Cascade Mountains, near Martin Station, Kittitas County, Washington (altitude about 8,000 feet).

Distribution.—Cascade Range, from southern British Columbia south through Washington and Oregon to the Siskiyou Mountains, California.

Characters.—Similar to *columbiensis*, but upperparts more brownish (less vinaceous); underparts darker, and tail paler (less brownish). Compared with *oregonensis:* Colors much less rufescent, especially on upperparts and underside of tail.

Color.—Winter pelage: Upperparts pale sayal brown (between sayal brown and wood brown), the sides sometimes faintly washed with pinkish cinnamon; upper surface of flying membrane clove brown; sides of face smoke gray or pale smoke gray, sometimes washed with light buff or pale fuscous; eye-ring fuscous; ears hair-brown; hind feet dark hair-brown (approaching fuscous), the toes marked with buffy white, the soles buffy white or yellowish white, edged with hair-brown; tail above, dark hair-brown, shading to fuscous, sometimes sparingly mixed with dull cinnamon or pinkish cinnamon; beneath, pale ochraceous-buff or light ochraceous-buff, edged on sides with fuscous, the bases of hairs pale smoke gray; underparts pinkish cinnamon or light pinkish cinnamon, the throat often creamy white.

Skull.—Closely similar to that of *columbiensis*, but averaging relatively narrower; similar to that of *oregonensis*, but slightly larger.

Measurements.—Average of 3 topotypes (adult): Total length, 308 (304–317); tail vertebræ, 144 (140–153); hind foot, 40.7 (40–42). *Skull:* Average of 10 (adult and subadult) from Easton and Keechelus Lake, Wash.: Greatest length, 41.4 (40.2–42.5); zygomatic breadth, 24.1 (23.5–24.9); mastoidal breadth, 18.7 (17.9–19.3); least interorbital breadth, 8.3 (7.7–9); least postorbital breadth, 9.1 (8.4–9.6); length of nasals, 12.9 (12.3–13.3); maxillary toothrow, 8.4 (8.2–8.4).

Type specimen.—No. 8058, Acad. Nat. Sci. Philadelphia (formerly No. 1058, collection S. N. Rhoads); ♂ subad., skin and skull; collected in March, 1893, by Allan Rupert.

Remarks.—This subspecies, occupying the Cascade Range in Washington and Oregon, is markedly paler than the coast form (*oregonensis*). It intergrades with the latter on the western slopes of the range, with *klamathensis* on the eastern slopes in Oregon, with *colum-*

biensis in southern British Columbia, and with *flaviventris* in northwestern California.

Specimens from Vida and Belknap Springs, Oreg., have browner backs and paler bellies than the typical series, thus showing approach to *oregonensis*. A specimen from Crater Lake, Oreg., approaches *klamathensis* in having paler and more yellowish underparts. Specimens from the Siskiyou Mountains, Cal., are intermediate between *fuliginosus* and *flaviventris*, agreeing with the former in the color of the upperparts and feet and in skull characters, but having the underparts paler and more yellowish than in typical specimens.

Specimens examined.—Total number, 68, as follows:

British Columbia: Hope, 7;[1, 2] Salmon River (mouth), 6.[3]
California: Preston Peak, 1; Siskiyou Mountains, 5.
Oregon: Belknap Springs, 2; Crater Lake, 1; McKenzie Bridge, 2; Vida, 3.[4]
Washington: Bumping Lake, Yakima County, 1; Cowlitz River, 1; Easton, 18; Keechelus Lake, 14; Martin Station, 3; Potato Hill, 15 miles north of Goldendale, 1; Signal Peak, Yakima Indian Reservation, 3.

GLAUCOMYS SABRINUS LATIPES Howell.

Broad-Footed Flying Squirrel.

[Pl. III, fig. 8; Pl. V, fig. 8; Pl. VII, fig. 8.]

Glaucomys sabrinus latipes Howell, Proc. Biol. Soc. Washington, XXVIII, p.112, May 27, 1915.

Type locality.—Glacier, British Columbia.

Distribution.—Selkirk Range, and other ranges in southeastern British Columbia, higher mountains of northern Idaho and northwestern Montana; south to Mullan and Orofino, Idaho.

Characters.—Similar to *fuliginosus* but larger; upperparts averaging darker and grayer; feet larger and darker. Compared with *alpinus* and *bangsi:* Size larger; upperparts more brownish (less drab); underparts darker.

Color.—*Winter pelage:* Upperparts drab, more or less mixed with sayal brown; sides of face smoke gray; ears fuscous; upper surface of flying membrane dark clove brown; hind feet fuscous; fore feet dark hair-brown, the toes shaded with buffy white; tail above, fuscous shaded with sayal brown; beneath, pinkish buff or light ochraceous-buff, more or less mixed with fuscous; underparts light ochraceous-buff or cinnamon-buff. *Summer pelage:* Upperparts chiefly sayal brown with a drab tinge, otherwise as in winter.

Skull.—Similar in general to that of *fuliginosus*, but larger (about equaling that of *bullatus*); longer and relatively narrower than that of *alpinus*.

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[1] Collection Mus. Comp. Zool.
[2] Collection E. R. Warren, Colorado Springs, Colo.
[3] Collection Victoria Mem. Mus.
[4] Two in collection Game Dept. Oregon.

Measurements.—Average of 10 adults:[1] Total length, 342 (315–368); tail vertebræ, 153 (145–161); hind foot, 41.4 (38–44). *Skull:* Average of 7 adults:[1] Greatest length, 42.9 (41.6–44.2); zygomatic breadth, 24.5 (24–25.4); mastoidal breadth, 19.5 (19–20); least interorbital breadth, 8.3 (8–8.8); least postorbital breadth, 8.8 (8–9.1); length of nasals, 13.3 (12.5–14); maxillary toothrow, 8.3 (7.9–9).

Type specimen.—No. 68753, U. S. Nat. Mus. (Biological Survey collection), ♀ ad., skin and skull; collected August 13, 1894, by J. Alden Loring.

Remarks.—This subspecies is one of the largest of the American flying squirrels, nearly equaling *bullatus* in external measurements and size of skull. Although evidently closely related to *fuliginosus* of the Cascades, intermediate specimens are unknown, but are likely to be found when further collecting is done in British Columbia. The present form apparently does not intergrade either with *alpinus* of the northern Rockies or with *bangsi* of the Bitterroot and Sawtooth Ranges in Idaho and Montana. From the latter race, the range of which meets that of *latipes* in northern Montana, this form differs in much larger size and darker colors. The range of *latipes* is apparently confined to the mountains, since another form (*columbiensis*) occurs in the Okanogan Valley and at Cranbrook, B. C. One specimen from the latter locality nearly matches specimens of *latipes* in color of the upperparts, but in other characters agrees with *columbiensis*.

Specimens examined.—Total number, 23, as follows:

British Columbia: Glacier, 1; Schoonover Mountain, near Okanogan (4,000 feet altitude), 2;[2] Shuswap, 1.
Idaho: Coolin, 4; Mullan, 7; Orofino, 1; Priest Lake, 1.
Montana: Nyack 1; Stanton Lake, 5.

GLAUCOMYS SABRINUS OLYMPICUS (Elliot).

Olympic Flying Squirrel.

[Pl. III, fig. 10; Pl. V, fig. 10; Pl. VII, fig. 6.]

Sciuropterus alpinus olympicus Elliot, Field Columb. Mus., Publ. 30, Zool. Ser., I, p. 225, Feb. 1, 1899.

Type locality.—Happy Lake, Olympic Mountains, Washington.

Distribution.—Olympic Peninsula, Washington, and south along the coast to southern Oregon; occurring in some localities with *oregonensis*.

[1] From Glacier, B. C.; Coolin, Idaho; and Stanton Lake and Nyack, Mont.
[2] Collection Provincial Mus., Victoria, B. C.

Characters.—Similar to *fuliginosus*, but upperparts, face, and feet much darker; colors much less rufescent than in *oregonensis*, both above and below; skull similar to that of *fuliginosus*, slightly larger than that of *oregonensis*.

Color.—*Worn summer pelage:* Upperparts wood brown; sides of face smoke gray shaded with cinnamon; eye-ring and upper surface of flying membrane fuscous-black; ears pale fuscous; feet fuscous, the soles shaded with buffy white; tail above, fuscous; beneath, dull light pinkish cinnamon, edged with fuscous; underparts whitish, heavily washed with pinkish cinnamon. *Winter pelage* (specimens from Ocean View, Oreg.):[1] Upperparts snuff brown; tail above, snuff brown heavily shaded with fuscous or fuscous-black; feet deep mouse gray; otherwise as in summer.

Skull.—Essentially the same as in *fuliginosus;* very similar to that of *oregonensis*, but averaging slightly larger.

Measurements.—Average of 4 topotypes (subadult): Total length, 335 (328–346); tail vertebræ, 162 (159–166); hind foot, 37.3 (35–39). *Skull:* Greatest length, 41 (40.3–41.6); zygomatic breadth, 23.9 (23.4–24.7); mastoidal breadth, 18.6 (18.4–19); least interorbital breadth, 8.2 (7.6–8.5); least postorbital breadth, 9.1 (8.8–9.4); length of nasals, 12.4 (11.2–13.2); maxillary toothrow, 8.4 (8.3–8.5).

Type specimen.—No. 5902, Field Mus. Nat. Hist.; ♂ subad., skin and skull; collected September 10, 1898, by D. G. Elliot.

Remarks.—The Olympic flying squirrel is apparently the darkest of the American forms. It is most nearly related to *oregonensis*, from which it differs in much less rufescent coloration. The material at hand is insufficient to show clearly whether the two races intergrade. The occurrence of typical specimens of both forms in the Olympic Mountains and at Gold Beach, Oreg., argues for their specific distinctness, but, on the other hand, a series from Ocean View, Oreg., strongly suggests intergradation, some of the specimens being clearly intermediate in color between *olympicus* and *oregonensis*. In view of the close cranial relationship which *olympicus* bears to both *oregonensis* and *fuliginosus* it seems best to unite it with them as a subspecies of *sabrinus*. To clear up the problem much additional material is needed—particularly a good series of winter specimens from the type region. At present the only available specimens in winter pelage are those from Ocean View, Oreg., which, as already explained, may be shading toward *oregonensis*.

Specimens examined.—Total number, 15, as follows:

Oregon: Gold Beach, 1;[2] Ocean View, 9.[3]
Washington: Olympic Mountains, 4;[2] Seattle, 1.[2]

[1] Possibly not typical—see Remarks.
[2] Collection Field Mus. Nat. Hist.
[3] Collection Game Dept. Oregon.

GLAUCOMYS SABRINUS BULLATUS Howell.

Sawtooth Mountains Flying Squirrel.

[Pl. III, fig. 12; Pl. V, fig. 12; Pl. VII, fig. 4.]

Glaucomys bullatus Howell, Proc. Biol. Soc. Washington, XXVIII, p. 113, May 27, 1915.

Type locality.—Sawtooth [Alturas] Lake, Idaho.

Distribution.—Sawtooth Mountains, Idaho, north to Cranbrook, British Columbia, and west to the Blue Mountains, Oregon (fig. 4).

Characters.—Similar to *klamathensis*, but larger, with much larger bullæ; upperparts more pinkish, underparts tinged with avellaneous instead of yellow, tail darker above and more vinaceous below, and soles of hind feet smoke gray instead of olive-ochre. Similar in color to *bangsi*, but upperparts decidedly more pinkish (less vinaceous or drab); gray on face purer and more extensive; size much larger.

Fig. 4.—Map showing the distribution of *Glaucomys sabrinus bullatus*, based on specimens examined. This form occurs in some localities with others of the same species (see fig. 3, p. 30).

Color.—Winter pelage: Upperparts between pinkish cinnamon and cinnamon-buff, shaded in some specimens with wood brown, becoming paler on the face; sides of face and neck pale smoke gray, this color extending back to a point slightly behind the ears; ears dark hair-brown edged with fuscous and often partly clothed with smoke gray hairs; upper surface of flying membrane between hair-brown and fuscous; feet between mouse gray and hair-brown, the fore feet and toes of hind feet often marked with grayish white, the soles pale smoke gray; tail above, pinkish cinnamon much mixed with fuscous, becoming dark mouse gray at tip; beneath, dull light pinkish cinnamon; underparts creamy white, strongly shaded with avellaneous or light pinkish cinnamon, becoming pure avellaneous on sides. *Summer pelage:* Hind feet somewhat paler (about mouse gray) but otherwise as in winter.

Skull.—Size large (averaging largest of the races of *sabrinus*); braincase relatively narrow and very deep, abruptly depressed posteriorly; interorbital region depressed and fronto-parietal region markedly elevated; interorbital region broad, the interorbital notch obsolete or much reduced; audital bullæ very large; basioccipital relatively narrow; molar teeth massive.

Measurements.—Type: Total length, 340; tail vertebræ, 150; hind foot, 46. Average of 6 adults from Ketchum, Idaho: Total length, 336 (327–354); tail vertebræ, 142 (135–150); hind foot, 42.5 (39–45). *Skull:* Average of type and of 5 adults from Ketchum, Idaho: Greatest length, 43.3 (42.4–44.2); zygomatic breadth, 25 (24.4–25.5); mastoidal breadth, 19.3 (19–20); least interorbital breadth, 8.9 (8.1–9.6); least postorbital breadth, 9.4 (9–9.7); length of nasals, 13.6 (13.5–13.9); maxillary toothrow, 9.1 (8.8–9.3).

Type specimen.—No. $\frac{34271}{31675}$, U. S. Nat. Mus. (Biological Survey collection): ♀ ad., skin and skull; collected September 28, 1890, by Vernon Bailey and B. H. Dutcher.

Remarks.—This race is the largest and one of the handsomest of the American flying squirrels. It was originally believed to be a distinct species, since it occurs at the same localities with *bangsi* in Idaho and with *latipes* in British Columbia, and does not intergrade with them, but recently acquired material from eastern Oregon shows intergradation with *klamathensis*. An adult from Beech Creek, Oreg., agrees well with typical *bullatus* in color, and its skull is slightly larger than the largest of the Idaho series; the braincase, however, is relatively broader and flatter. Another adult from Cornucopia, Oreg., approaches *klamathensis* in having the belly and the soles tinged with colonial buff. A specimen from Cranbrook, British Columbia, differs from the Idaho series in having the underparts a slightly darker shade of cinnamon and the tail more extensively shaded with fuscous.

Specimens examined.—Total number, 14, as follows:

British Columbia: Cranbrook, 1.
Idaho: Ketchum, 6;[1] Sawtooth Lake, 2.
Oregon: Anthony, 1;[2] Beech Creek, 1; Cornucopia, 3.

GLAUCOMYS SABRINUS KLAMATHENSIS (Merriam).

Klamath Flying Squirrel.

[Pl. III, fig. 3; Pl. V, fig. 3; Pl. VII, fig. 3.]

Sciuropterus alpinus klamathensis Merriam, Proc. Biol. Soc. Washington, XI, p. 225, July 15, 1897.

Type locality.—Fort Klamath, Oregon.

Distribution.—Central Oregon, chiefly east of the Cascades; northern and eastern limits unknown.

Characters.—Similar to *fuliginosus* but upperparts averaging slightly paler; gray on face purer and more extensive (less mixed with buff); underparts paler, usually washed with pale yellow; soles strongly tinted with yellow; audital bullæ larger. Similar to *bullatus*

[1] Collection Mus. Comp. Zool. [2] Collection Amer. Mus. Nat. Hist.

but bullæ smaller, colors paler, and underparts and soles shaded with yellowish.

Color.—*Winter pelage:* Upperparts cinnamon-drab or pale sayal brown shading in some specimens to light yellowish drab; sides of face smoke gray, often considerably washed with pinkish cinnamon; upper surface of flying membrane fuscous; ears drab or pale hair-brown; hind feet hair-brown, the soles olive-ochre or deep colonial buff; fore feet light brown mixed with buffy white; tail above, sayal brown or dull cinnamon, much mixed with hair-brown, the tip nearly pure hair-brown; beneath, pinkish buff, light pinkish cinnamon, or colonial buff, moderately shaded with hair-brown, chiefly on sides; underparts whitish, rather heavily washed with colonial buff or cream-buff, shading to light pinkish cinnamon along sides.

Skull.—Similar to that of *fuliginosus* but with larger bullæ; similar to that of *bullatus* but smaller, with smaller bullæ and flatter braincase.

Measurements.—Average of 9 topotypes (adult and subadult): Total length, 319 (300–336); tail vertebræ, 144 (135–154); hind foot, 40.4 (39.5–42). *Skull:* Average of 6 topotypes (adult and subadult): Greatest length, 40.9 (40.2–42.3); zygomatic breadth, 23.6 (23.2–25); mastoidal breadth, 18.9 (18.6–19.6); least interorbital breadth, 7.8 (7–9); least postorbital breadth, 9.2 (8.6–10); length of nasals, 12.7 (11.8–13.9); maxillary toothrow, 8.6 (8.1–9).

Type specimen.—No. 87310, U. S. Nat. Mus. (Biological Survey collection); ♀ ad., skin and skull; collected January 11, 1897, by B. L. Cunningham.

Remarks.—This race occupies the interior of Oregon, chiefly east of the Cascades, but extending into the eastern foothills of that range and occasionally as high as Crater Mountain (4 miles south of Crater Lake). It intergrades with *fuliginosus* in the Cascades and with *flaviventris* in northeastern California. A series of specimens from Davis Mountain, Crook County, Oreg., exhibit the characters of the subspecies in a more pronounced way than the series from the type locality. In color they are more drab above and have the underparts and feet more intensely yellowish; the skulls average somewhat larger. A specimen from Paulina Lake, Oreg., differs from typical specimens in having gray instead of yellow feet, and approaches *fuliginosus* also in the color of the back and underparts.

Specimens examined.—Total number, 27, as follows:

Oregon: Crater Mountain (4 miles south of Crater Lake), 1; Davis Mountain, Crook County, 7;[1] Fort Klamath, 17; Paulina Lake, 1; "Upper Klamath" [Lake], 1.[2]

[1] Collection Game Dept. Oregon. [2] Collection Field Mus. Nat. Hist.

GLAUCOMYS SABRINUS FLAVIVENTRIS Howell.

YELLOW-BELLIED FLYING SQUIRREL.

[Pl. III, fig. 2; Pl. V, fig. 2; Pl. VII, fig. 2.]

Glaucomys sabrinus flaviventris Howell, Proc. Biol. Soc. Wash., XXVIII, p. 112, May 27, 1915.

Type locality.—Head of Bear Creek, Trinity County, California (altitude, 6,400 feet).

Distribution.—Northern California, from the Trinity Mountains in Siskiyou and Trinity Counties east to the Warner Mountains, Modoc County.

Characters.—Similar to *klamathensis* but smaller, with much smaller audital bullæ; underparts and feet more strongly suffused with yellow or buff; tail darker beneath.

Color.—Summer pelage: Upperparts pale sayal brown varying in some specimens to drab; sides of head smoke gray, often tinged with buff; ears hair-brown; upper surface of flying membrane fuscous; feet hair-brown, often tinged with pale greenish yellow, the soles oil yellow; tail above, dark buffy brown, shading to pale fuscous at tip; beneath, brownish cream-buff, bordered on sides with pale fuscous or hair-brown; underparts whitish, usually heavily washed with pale greenish yellow or Naples yellow, shading to wood brown along sides; a small white patch on throat, the hairs white to the roots.

Skull.—Similar to that of *klamathensis*, but decidely smaller, with much smaller bullæ; much smaller than that of *fuliginosus;* closely similar to that of *lascivus.*

Measurements.—Average of 5 topotypes (adult): Total length, 306 (286–322); tail vertebræ, 133 (122–140); hind foot, 40.4 (40–42). *Skull:* Greatest length, 39.5 (38.7–40.4); zygomatic breadth, 23.5 (23.2–24.2); mastoidal breadth, 17.9 (17.6–18.7); least interorbital breadth, 7.2 (6.3–8.3); least postorbital breadth, 8.9 (8.2–9.8); length of nasals, 12.3 (11.8–12.6); maxillary toothrow, 8.4 (7.7–8.8).

Type specimen.—No. 13319, Mus. Vert. Zool., Univ. California; ♂ ad., skin and skull; collected August 13, 1911, by Annie M. Alexander.

Remarks.—This race is apparently most nearly related to *lascivus* of the Sierra Nevada, from which it differs widely in color of underparts. It differs so much from *oregonensis*, both in color and cranial characters, that intergradation between them seems very improbable. Specimens from the Warner Mountains, Cal., are intermediate between this form and *klamathensis;* in color they resemble *flaviventris*, but one of the two individuals has a skull equaling that of *klamathensis*, though with smaller bullæ. A large series from Rush Creek, Siskiyou County, average slightly less yellowish beneath and have somewhat larger skulls than typical specimens, some of them equaling

skulls of *fuliginosus* in size. Intergradation with *lascivus* occurs in the region around Mount Lassen.

Specimens examined.—Total number, 27, as follows:

California:[1] Bear Creek, Trinity County (head, altitude, 6,400 feet), 5; Castle Lake, Siskiyou County, 2; Grizzly Creek, Trinity County (altitude, 6,000 feet), 1; Jackson Lake, Siskiyou County, 3; Rush Creek, Siskiyou County, 14; Warner Mountains, 2.

GLAUCOMYS SABRINUS LASCIVUS (Bangs).

Sierra Flying Squirrel.

[Pl. III, fig. 5; Pl. V, fig. 5; Pl. VII, fig. 1.]

Sciuropterus alpinus lascivus Bangs, Proc. New England Zool. Club, I, p. 69, July 31, 1899.

Type locality.—Tallac, Eldorado County, California.

Distribution.—Sierra Nevada Range and northward to eastern Shasta County, California.

Characters.—Similar to *flaviventris*, but slightly smaller, with smaller hind foot; underparts without yellow suffusion. Compared with *klamathensis:* Size smaller; color above more drab (less brownish); underparts and feet less yellowish. Similar in color to *stephensi*, but paler.

Color.—*Winter pelage:* Upperparts wood brown shading to drab; sides of face smoke gray, often shaded with pale fuscous; upper surface of flying membrane blackish brown; ears fuscous-black; hind feet hair-brown, the toes shaded with whitish or buff; fore feet mouse gray; tail above, fuscous-black mixed with wood brown or pale snuff brown; beneath, drab-gray shading to avellaneous; underparts grayish white faintly washed with avellaneous. *Summer pelage:* Upperparts more brownish, usually rich wood brown; underparts faintly washed with cartridge buff or light pinkish cinnamon; upper surface of membranes clove brown; hind feet pale hair-brown, the soles whitish drab or faintly tinged with olive-buff; under side of tail pinkish buff.

Skull.—Essentially like that of *flaviventris;* much smaller than that of *klamathensis* and of *fuliginosus.*

Measurements.—Average of 5 topotypes (adult and subadult): Total length, 303 (295–320); tail vertebræ, 133 (125–150); hind foot, 40.2 (39–43). Average of 11 from Cisco, Cal.: 292; 122; 37.5. *Skull:* Average of 4 topotypes (adult and subadult): Greatest length, 40.4 (39.5–41.5); zygomatic breadth, 23.5 (23–24.1); mastoidal breadth, 18.2 (17.7–18.8); least interorbital breadth, 7.4 (7.1–7.8); least postorbital breadth, 9.2 (9–9.5); length of nasals, 13 (12.7–13.2); maxillary toothrow, 8.1.

[1] All in collection Mus. Vert. Zool., Univ. California.

Type specimen.—No. 9186, Mus. Comp. Zool. (formerly in collection of E. A. and O. Bangs); ♀ subad., skin and skull; collected August 28, 1898, by W. W. Price and P. O. Simons.

Remarks.—The Sierra flying squirrel is closely related to *flaviventris* of northern California, but differs markedly from it in the color of the underparts, tail, and feet. Intergradation between the two forms is shown by specimens from Mount Lassen, Dana, Prattville, and Castle Lake, Siskiyou County, which approach *flaviventris* in having the soles yellowish and the underparts tinged with the same. One specimen from Echo, close to the type locality, also has yellow soles and a buffy tail, but no yellow on the belly. In a large series from Cisco, Cal., most of the specimens show indications of being stained on the underparts with soot. Intergradation with *californicus* is probable, but there is no material available from the southern Sierra to show it. This race is very similar in color to *alpinus* of the northern Rocky Mountains, but is of much smaller size and has a paler tail.

Specimens examined.—Total number, 34, as follows:

California: Blue Canyon, 3;[1] Cisco, 18;[1] Dana, 1; Echo, 1;[2] Fort Crook, 1; Fresno [=mountains near ?], 1 (skeleton); Kings River Canyon, 1; Mill Creek, south base Mount Lassen, 1; Mount Tallac, 4;[2, 3] Prattville (12 miles northeast), 1; Quincy, 1; Red Point, Placer County, 1.[4]

GLAUCOMYS SABRINUS CALIFORNICUS (Rhoads).

San Bernardino Flying Squirrel.

[Pl. III, fig. 9; Pl. V, fig. 9; Pl. VII, fig. 5.]

Sciuropterus alpinus californicus Rhoads, Proc. Acad. Nat. Sci., Philadelphia, p. 323, June, 1897.

Sciuropterus californicus Grinnell, Univ. California, Publ. Zool., V, pp. 138–139, 1908.

Type locality.—Squirrel Inn, San Bernardino Mountains, California (altitude, 5,200 feet).

Distribution.—San Bernardino and San Jacinto Mountains, California.

Characters.—Similar to *lascivus*, but upperparts paler and more grayish; face between eyes usually washed with gray; skull smaller.

Color.—Unworn pelage (April to August): Upperparts light drab, shaded in some specimens with yellowish wood brown; sides of face pale smoke gray; front of face often washed with gray; ears hair-brown; upper surface of flying membrane fuscous; feet hair-brown or mouse gray, the toes whitish or buffy white, the soles buffy white or olive-buff; tail above, hair-brown, sparingly mixed with

[1] Collection Mus. Vert. Zool., Univ. California.
[2] Collection Mus. Comp. Zool.
[3] Collection Acad. Nat. Sci. Philadelphia.
[4] Collection Leland Stanford, Jr., Univ.

sayal brown; beneath, pinkish buff or pale olive-buff, edged on sides with hair-brown; underparts soiled whitish, faintly shaded with cartridge buff.

Skull.—Similar to that of *lascivus*, but averaging smaller, with shorter nasals and smaller bullæ.

Measurements.—Average of 8 adults from San Bernardino Mountains, Cal.: Total length, 297 (280–312); tail vertebræ, 137 (127–149); hind foot, 37.6 (36–39). *Skull:* Average of 5 adults from same locality: Greatest length, 39 (37.3–40); zygomatic breadth, 22.8 (22.3–23.5); mastoidal breadth, 17.7 (17.2–18.1); least interorbital breadth, 7.8 (7.4–8.2); least postorbital breadth, 8.7 (7.9–9.6); length of nasals, 11.9 (11.3–12.4); maxillary toothrow, 8.1 (7.5–8.6).

Type specimen.—No. 10487, Acad. Nat. Sci. Philadelphia (formerly No. 3487, collection S. N. Rhoads); ♀ ad., skin and skull; collected June 5, 1896, by R. B. Herron.

Remarks.—This subspecies is the grayest of the races of *sabrinus*, being considerably paler than *alpinus*. It is closely related to *lascivus* of the Sierra, and probably intergrades with it, though no intermediate specimens have thus far been collected.

Specimens examined.—Total number, 9, as follows:

California: San Bernardino Mountains, 8;[1] San Jacinto Mountains, 1.[2]

GLAUCOMYS SABRINUS STEPHENSI (Merriam).

California Coast Flying Squirrel.

[Pl. III, fig. 1; Pl. V, fig. 1; Pl. VII, fig. 9.]

Sciuropterus oregonensis stephensi Merriam, Proc. Biol. Soc. Washington, XIII, p. 151, June 13, 1900.

Type locality.—Sherwood, Mendocino County, California.

Distribution.—Coast region of northern California; limits of range unknown.

Characters.—Similar to *lascivus*, but upperparts more reddish (less drab); soles whiter (never tinged with yellowish) and toes less distinctly marked with buffy or white; skull with very deep braincase. Compared with *oregonensis:* Upperparts and tail less reddish; underparts whiter. Compared with *fuliginosus:* Size much smaller; color above in fresh pelage somewhat grayer (less ochraceous) and underparts paler.

Color.—Fresh winter pelage: Upperparts wood brown; sides of face pale smoke gray; upper surface of flying membrane fuscous or

[1] Three in collection Acad. Nat. Sci. Philadelphia; three in Mus. Vert. Zool., Univ. California; one in Mus. Comp. Zool.

[2] Collection Mus. Vert. Zool., Univ. California.

fuscous-black; feet hair-brown, the soles buffy white; tail above, hair-brown, shaded with fuscous-black, darkest at tip; beneath, pale pinkish buff edged with hair-brown; underparts whitish, irregularly washed with light pinkish cinnamon. *Worn winter pelage* (May): Upperparts decidedly more brownish, about sayal brown; tail above, somewhat browner; beneath, light pinkish buff, edged with fuscous. *Summer pelage* (July): Similar to spring pelage but underside of tail darker (pinkish buff).

Skull.—Similar to that of *oregonensis* and of *lascivus*, but averaging slightly smaller, with relatively shorter nasals and slightly smaller bullæ; braincase deeper and more abruptly depressed.

Measurements.—Average of 3 adults from Laytonville, Cal.: Total length, 307 (300–310); tail vertebræ, 143 (133–149); hind foot, 39.3 (38–40) *Skull:* Average of 3 adults from Laytonville, Cal.: Greatest length, 40 (39.7–40.5); zygomatic breadth, 23.5 (23–24); mastodial breadth, 18.3 (18.3–18.4); least interorbital breadth, 7.9 (7.6–8.4); least postorbital breadth, 9.2 (8.6–9.9); length of nasals, 11.7 (11.1–12.6); maxillary toothrow, 7.9 (7.3–8).

Type specimen.—No. 99830, U. S. Nat. Mus. (Biological Survey collection); ♀ subad., skin and skull; collected May 10, 1894, by F. Stephens.

Remarks.—This race, as indicated by its skull, is closely related to *oregonensis;* in color it resembles *lascivus* rather closely, and doubtless intergrades with both it and *oregonensis.* The type (from Sherwood) and one nearly adult specimen from Laytonville have skulls in which the occipital region is very abruptly decurved, but in two other adults from the same locality this character is less pronounced. A specimen, without skull, from 8 miles southeast of Cecilville—within the known range of *flaviventris*—agrees essentially with the type of *stephensi*, and thus suggests that intergradation does not occur between these two races.

Specimens examined.—Total number, 6, as follows:

California: Cecilville (8 miles southeast), 1;[1] Eureka, 1;[2] Laytonville, 3;[3] Sherwood, 1.

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[1] Collection Mus. Vert. Zool., Univ. California.
[2] Collection Leland Stanford, Jr., Univ.
[3] Collection California Acad. Sci.

TABLES OF CRANIAL MEASUREMENTS.

TABLE I.—*Glaucomys volans.*

No.	Species and locality.	Sex.	Greatest length.	Zygomatic breadth.	Mastoidal breadth.	Interorbital breadth.	Postorbital breadth.	Length of nasals.	Maxillary toothrow.	Remarks.
	Glaucomys volans volans:		*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	
155510	Washington, D. C	♀	34.1	20.9	17	7	9.1	9.6	6.2	Adult.
155517	Do	♀	34.9	20.9	16.6	7.3	9.3	9.8	6.3	Subadult.
155518	Do	♂	35.4	21.2	16.8	7	9.2	10.1	6.5	Adult.
155512	Do	♂	34.6	20.4	16.5	6.2	8.6	9.2	6	Do.
47683	Lake George, N. Y	♂	33.9	21.1	16.6	6.5	8.4	9.6	5.6	Do.
78010	Wilmington, Mass	♀	35.7	22.1	17	7.5	8.9	9.9	6.6	Do.
194040	Elk River, Minn	♂	33.6	20.5	16.5	6.9	9.1	9.1	6.5	Do.
194033	Do	♀	35.5	21.5	16.7	7	9.4	9.9	6.4	Do.
	Glaucomys v. querceti:									
[1] 2451	Citronelle, Fla	♀	35.3	20.9	17.5	6.6	8.2	9.4	6.3	Adult; type.
[1] 2453	Do	♂	34.4	20.7	.....	6.9	8.6	9	6.4	Adult.
78969	Lake Harney, Fla	♂	34.3	20.7	17.5	6.8	8.3	9.6	6.5	Subadult.
72572	Enterprise, Fla	♂	34.5	19.5	16.8	7.2	8.7	9.6	6.4	Do.
	Glaucomys v. saturatus:									
178364	Dothan, Ala	♀	33.8	20.2	17	6.8	9.1	9.7	6.4	Adult.
178366	Do	♀	34.9	20.4	17.4	7.2	8.3	9.5	6.5	Adult; type.
178363	Do	♂	34.4	20.5	17.3	7.3	9	10	6.7	Adult.
57032	Greensboro, Ala	♂	34.3	20.2	16.8	7.3	8.4	9.7	6.2	Do.
	Glaucomys v. texensis:									
136790	Sour Lake, Tex	♂	32.7	20.6	17.1	7	8.2	9.5	6.4	Subadult.
136400	Do	♂	34	20.9	17.2	7.3	8.9	9.2	6.3	Old adult; type.
136401	Do	♀	33.6	21	17.2	7.3	8.9	9.2	6.2	Adult.
136402	Do	♀	33.6	20.9	17.4	6.9	8.5	9.2	6.1	Do.
	Glaucomys v. goldmani:									
132833	Teopisca, Chiapas	♂	35.1	21.3	17.8	7.2	8.7	10.3	6.4	Adult; type.
132834	Do	♀	34.9	21.9	17.5	7.2	9.2	9.9	6.3	Adult.

[1] Collection Mus. Comp. Zool.

TABLE II.—*Glaucomys sabrinus.*

No.	Species and locality.	Sex.	Greatest length.	Zygomatic breadth.	Mastoidal breadth.	Interorbital breadth.	Postorbital breadth.	Length of nasals.	Maxillary toothrow.	Remarks.
	Glaucomys sabrinus sabrinus:		*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	
[1] ——	Cochrane, Ontario	♂	40	24	18.1	7.3	8.9	11.5	7.8	Subadult.
[2] 7596	Lake Edward, Quebec	♀	39.4	24.2	18.5	8.1	9.7	11.4	7.3	Adult.
[3] 5432	Big Island, Mackenzie	....	40.2	24.2	19.2	8.2	9.2	12.8	8.1	Subadult.
3756	Winnipeg, Manitoba	♀	39.4	24.3	18	7.8	9.3	12	7.7	Do.
	Glaucomys s. makkovikensis									
[3] 13451	Makkovik, Labrador	....	40.8	24.7	.....	7.3	10	12.2	7.4	Adult.
[3] 13453	Do	....	40.4	24.4	18.6	7.6	9.7	11.1	7.9	Do.
	Glaucomys s. macrotis:									
83152	Hunter Mountain, N. Y	♀	37.5	22.4	17.5	7	9.3	10.6	7.1	Adult; type.
111075	Peterboro, N. Y	♂	36.7	22.4	17.7	7.1	9.2	10.5	6.4	Adult.
71175	Ossipee, N. H	♂	36	22.3	17.2	6.9	8.6	10.5	7.2	Do.
[3] 4960	Greenville, Me	♀	38.7	23.5	17.9	6.8	8.9	10.1	6.7	Do.
	Glaucomys s. canescens:									
[2] 7662	Portage la Prairie, Manitoba	♂	38.5	22.8	17.5	7.7	9.2	11.5	7.7	Do.
[2] 7663	Do	♀	38.8	22.9	17.6	7.6	9.5	11.2	7.6	Adult; type.

[1] Collection Carnegie Mus.; not numbered.
[2] Collection Field Mus. Nat. Hist.
[3] Collection Mus. Comp. Zool.

TABLE 11.—*Glaucomys sabrinus*—Continued.

No.	Species and locality.	Sex.	Greatest length.	Zygomatic breadth.	Mastoidal breadth.	Interorbital breadth.	Postorbital breadth.	Length of nasals.	Maxillary toothrow.	Remarks.
			Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm*	*Mm.*	
	Glaucomys s. bangsi:									
[1] 6959	Idaho Co., Idaho	♂	38.8	23.7	18.6	7.4	8.4	11.5	8.7	Subadult; type.
31674	Sawtooth Lake, Idaho	♂	40.9	24.8	18.7	7.8	9	11.8	8.7	Adult.
109169	Florence, Mont	♀	41.2	24.7	19.1	7.8	9	12.4	8	Do.
	Glaucomys s. olpinus:									
88646	Jasper House, Alberta	♂	41.4	25.4	19.4	8	9	12.4	8.1	Do.
174398	Henry House, Alberta	♀	41.2	25.1	19.4	8.2	9.1	12.6	7.5	Do.
174397	Do	♀	42	25.6	19.4	8.8	9.6	12.4	7.9	Subadult.
	Glaucomys s. yukonensis:									
35320	Camp Davidson, Alaska	♀	41.5	25.3	19.5	7.8	10.3	12	7.9	Adult; type.
180338	Tanana, Alaska	♀	41	25.1	19.7	8.3	8.9	11.6	8.4	Adult.
	Glaucomys s. zophœus:									
136137	Helm Bay, Alaska	♀	41.5	26.2	19.1	8.3	9	12.9	8	Adult; type.
136138	Do	♂	40.1	24.2	18.2	7.4	8.8	12.3	8.3	Subadult.
[2] 8790	Bradfield Canal, Alaska	♀	41.2	24.7	18.9	8.4	9.2	12.6	7.8	Very old.
	Gloucomys s. oregonensis:									
[3] 253	Columbia River, Oreg	....	40.5+	24.8	19	8.5	8.9	12.4	8.1	Adult; type.
[4] 146	Salem, Oreg	♂	40.7	24.9	18.6	8.1	8.7	12.9	8.7	Adult.
141952	Portland, Oreg	♂	40.5	23.7	19	8.8	9	12.5	8	Do.
69416	Gold Beach, Oreg	♀	38.5	23	18.2	7.6	8.1	10.9	7.9	Old adult.
	Glaucomys s. columbiensis:									
94310	Okanogan, B. C	♂	40.5	24.4	18.9	7.7	9.2	12	7.7	Subadult; type.
[5] 1026	Penticton, B. C	♀	41.2	25.2	19.4	7.7	8.4	12.9	7.7	Old adult.
206543	Cranbrook, B. C	♀	41.6	24.6	19.5	8.6	9	12.6	8	Do.
	Gloucomys s. fuliginosus:									
[3] 8058	Martin Station, Wash	♂	39.5	23.7	.....	8.4	9.3	12.6	8.6	Subadult; type.
93282	Keechelus Lake, Wash	♀	42.5	24.3	19.1	9	9.6	13	8.8	Subadult.
93144	Do	....	41.9	24.4	18.8	8.6	8.8	13	8.2	Adult.
	Glaucomys s. latipes:									
68573	Glacier, B. C	♀	44.2	25.1	20	8.3	9	14	8.8	Adult; type.
159393	Coolin, Idaho	♀	43.7	24.2	19.5	8	9	13.6	9	Adult.
159394	Do	♂	41.6	24	19	8	8.8	12.5	8	Do.
	Glaucomys s. olympicus:									
[6] 5902	Olympic Mountains, Wash	♂	41.5	23.7	18.4	8.2	8.8	13.2	8.5	Subadult; type.
[6] 5905	Do	♂	41.6	24.7	19	8.4	8.9	12.5	8.3	Subadult.
[6] 5904	Do	♂	40.5	23.7	18.5	7.6	9.2	12.5	8.3	Do.
	Glaucomys s. bullatus:									
31675	Sawtooth Lake, Idaho	♀	44	25	19	8.7	9.6	13.9	9.2	Adult; type.
[1] 8499	Ketchum, Idaho	♂	44.2	25.5	19.4	9.6	9.2	13.5	9.3	Adult.
[1] 8495	Do	♂	42.6	24.4	19	8.1	9	13.9	9.2	Do.
	Glaucomys s. klomathensis:									
87310	Fort Klamath, Oreg	♀	40.6	24	18.8	9	8.7	12.6	8.1	Old adult; type.
193991	Do	♂	40.2	23.4	19	7.8	10	12.7	8.4	Old adult.
87305	Do	....	42.3	25	19.6	8.3	9.4	13.9	8.7	Adult.
	Glaucomys s. flaviventris:									
[2] 13319	Bear Creek, Trinity Co., Cal.	♂	40	23.4	17.9	7.9	9.3	12.3	8.1	Adult; type.
[2] 13321	Do	♂	40.4	24.2	18.7	8.3	9.8	11.8	8.7	Adult.
[2] 13318	Do	♀	38.7	23.3	17.6	7.2	8.7	12.6	7.7	Do.
	Glaucomys s. lascivus:									
[1] 9186	Mount Tallac, Cal	♀	39.5	23	17.7	7.8	9.5	12.8	8.1	Subadult; type.
[1] 9187	Do	♀	1.5	23.3	18.8	7.2	9.2	13.2	8.2	Subadult.
[3] 11458	Do	♀	40.4	24.1	18.4	7.6	9	12.7	.....	Adult.
	Gloucomys s. californicus:									
[3] 10487	San Bernardino Mountains, Cal.	♀	39.3	23.5	17.6	8.2	9.2	11.7	8.1	Old adult; type.
[3] 10486	Do	♀	37.3	22.3	18.1	7.4	7.9	11.3	7.5	Old adult.
[1] 8646	Do	♀	40	22.9	18	7.4	8.4	12.1	7.7	Do.
	Glaucomys s. stephensi:									
99830	Sherwood, Cal	♀	38.4	22.5	17.4	7.4	9.5	11.7	7.5	Subadult type.

[1] Collection Mus. Comp. Zool.
[2] Collection Mus. Vert. Zool., Univ. California.
[3] Collection Acad. Nat. Sci., Philadelphia.
[4] Collection Game Dept. Oregon.
[5] Collection Victoria Mem. Mus.
[6] Collection Field Mus. Nat. Hist.

EXPLANATION OF PLATES.

[All natural size.]

PLATE II.

Fig. 1. *Glaucomys volans saturatus*, ♂ ad., Dothan, Ala. (No. 178363, U. S. Nat. Mus., Biological Survey collection).

Fig. 2. *Glaucomys volans volans*, ♀ ad., Cleveland Park, D. C. (No. 155517, U. S. Nat. Mus.).

Fig. 3. *Glaucomys sabrinus bangsi*, ad., Florence, Mont. (No. 168243, U. S. Nat. Mus., Biological Survey collection).

Fig. 4. *Glaucomys sabrinus alpinus*, ♀ ad., Henry House, Alberta (No. 174398, U. S. Nat. Mus.).

Fig. 5. *Glaucomys volans texensis*, ♀ ad., Sour Lake, Tex. (No. 136402, U. S. Nat. Mus., Biological Survey collection).

Fig. 6. *Glaucomys volans goldmani*, ♀ ad., Teopisca, Chiapas (No. 132834, U. S. Nat. Mus., Biological Survey collection).

Fig. 7. *Glaucomys sabrinus canescens*, ♀ ad. (type), Portage la Prairie, Manitoba (No. 7663, Field Mus. Nat. Hist.).

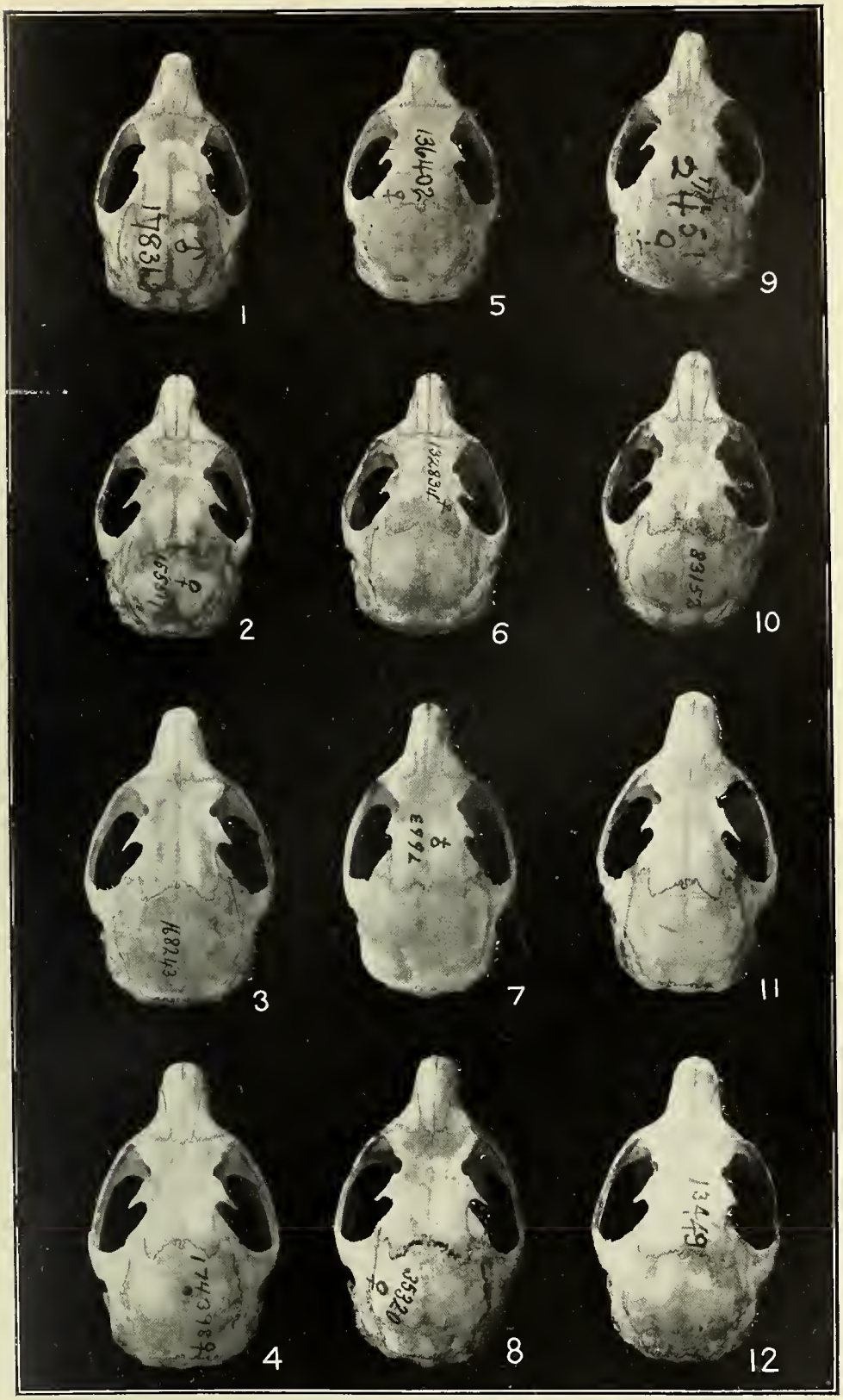
Fig. 8. *Glaucomys sabrinus yukonensis*, ♀ ad. (type), Camp Davidson, Alaska (No. 35320, U. S. Nat. Mus.).

Fig. 9. *Glaucomys volans querceti*, ♀ ad. (type), Citronelle, Fla. (No. 2451, Mus. Comp. Zool.).

Fig. 10. *Glaucomys sabrinus macrotis*, ♀ ad. (type), Catskill Mountains, N. Y. (No. 83152, U. S. Nat. Mus.).

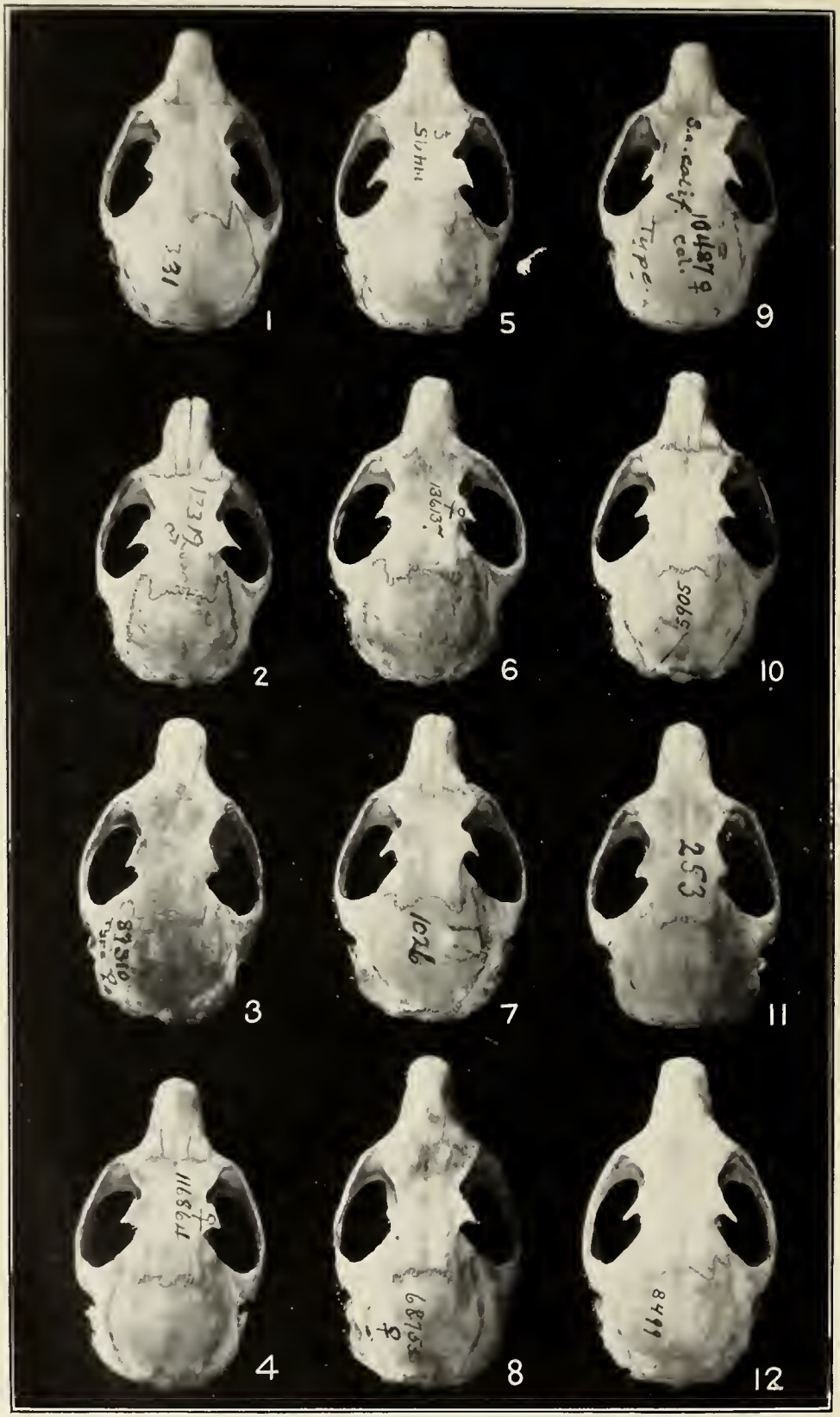
Fig. 11. *Glaucomys sabrinus sabrinus*, ♂ subad., Cochrane, Ontario (Carnegie Mus., not numbered).

Fig. 12. *Glaucomys sabrinus makkovikensis*, ad., Makkovik, Labrador (No. 13449, Mus. Comp. Zool.).



SKULLS OF GLAUCOMYS VOLANS AND G. SABRINUS.

1. G. v. saturatus.
2. G. v. volans.
3. G. s. bangsi.
4. G. s. alpinus.
5. G. v. texensis.
6. G. v. goldmani.
7. G. s. canescens.
8. G. s. yukonensis.
9. G. v. querceti.
10. G. s. macrotis.
11. G. s. sabrinus.
12. G. s. makkovikensis.



SKULLS OF GLAUCOMYS SABRINUS.

1. G. s. stephensi.
2. G. s. flaviventris.
3. G. s. klamathensis.
4. G. s. fuliginosus.
5. G. s. lascivus.
6. G. s. zaphæus.
7. G. s. columbiensis.
8. G. s. latipes.
9. G. s. californicus.
10. G. s. olympicus.
11. G. s. oregonensis.
12. G. s. bullatus.

Plate III.

Fig. 1. *Glaucomys sabrinus stephensi*, ♂ ad., Laytonville, Cal. (No. 331, Cal. Acad. Sci.)

Fig. 2. *Glaucomys sabrinus flaviventris*, ♂ ad. (type), Bear Creek, Trinity County, Cal. (No. 13319, Mus. Vert. Zool.).

Fig. 3. *Glaucomys sabrinus klamathensis*, ♀ ad. (type), Fort Klamath, Oreg. (No. 87310, U. S. Nat. Mus., Biological Survey collection).

Fig. 4. *Glaucomys sabrinus fuliginosus*, ♀ ad., Easton, Wash. (No. 116864, U. S. Nat. Mus., Biological Survey collection).

Fig. 5. *Glaucomys sabrinus lascivus*, ♀ ad., Cisco, Cal. (No. 19495, Mus. Vert. Zool.).

Fig. 6. *Glaucomys sabrinus zaphœus*, ♀ ad. (type), Helm Bay, Alaska (No. 136137, U. S. Nat. Mus., Biological Survey collection).

Fig. 7. *Glaucomys sabrinus columbiensis*, ♀ ad., Penticton, B. C. (No. 1026, Victoria Mem. Mus.).

Fig. 8. *Glaucomys sabrinus latipes*, ♀ ad. (type), Glacier, B. C. (No. 68573, U. S. Nat. Mus., Biological Survey collection).

Fig. 9. *Glaucomys sabrinus californicus*, ♀ ad. (type), San Bernardino Mountains, Cal. (No. 10487, Acad. Nat. Sci. Philadelphia).

Fig. 10. *Glaucomys sabrinus olympicus*, ♂ subad., Olympic Mountains, Wash. (No. 5905, Field Mus. Nat. Hist.).

Fig. 11. *Glaucomys sabrinus oregonensis*, ad. (type), Columbia River, Oreg. (No. 253, Acad. Nat. Sci. Philadelphia).

Fig. 12. *Glaucomys sabrinus bullatus*, ♂ ad., Ketchum, Idaho (No. 8499, Mus. Comp. Zool.).

PLATE IV.

Fig. 1. *Glaucomys volans saturatus*, ♂ ad., Dothan, Ala. (No. 178363, U. S. Nat. Mus., Biological Survey collection).

Fig. 2. *Glaucomys volans volans*, ♀ ad., Cleveland Park, D. C. (No. 155517, U. S. Nat. Mus.).

Fig. 3. *Glaucomys sabrinus bangsi*, ad., Florence, Mont. (No. 168243, U. S. Nat. Mus., Biological Survey collection).

Fig. 4. *Glaucomys sabrinus alpinus*, ♀ ad., Henry House, Alberta (No. 174398, U. S. Nat. Mus.).

Fig. 5. *Glaucomys volans texensis*, ♀ ad., Sour Lake, Tex. (No. 136402, U. S. Nat. Mus., Biological Survey collection).

Fig. 6. *Glaucomys volans goldmani*, ♀ ad., Teopisca, Chiapas (No. 132834, U. S. Nat. Mus., Biological Survey collection).

Fig. 7. *Glaucomys sabrinus canescens*, ♀ ad. (type), Portage la Prairie, Manitoba (No. 7663, Field Mus. Nat. Hist.).

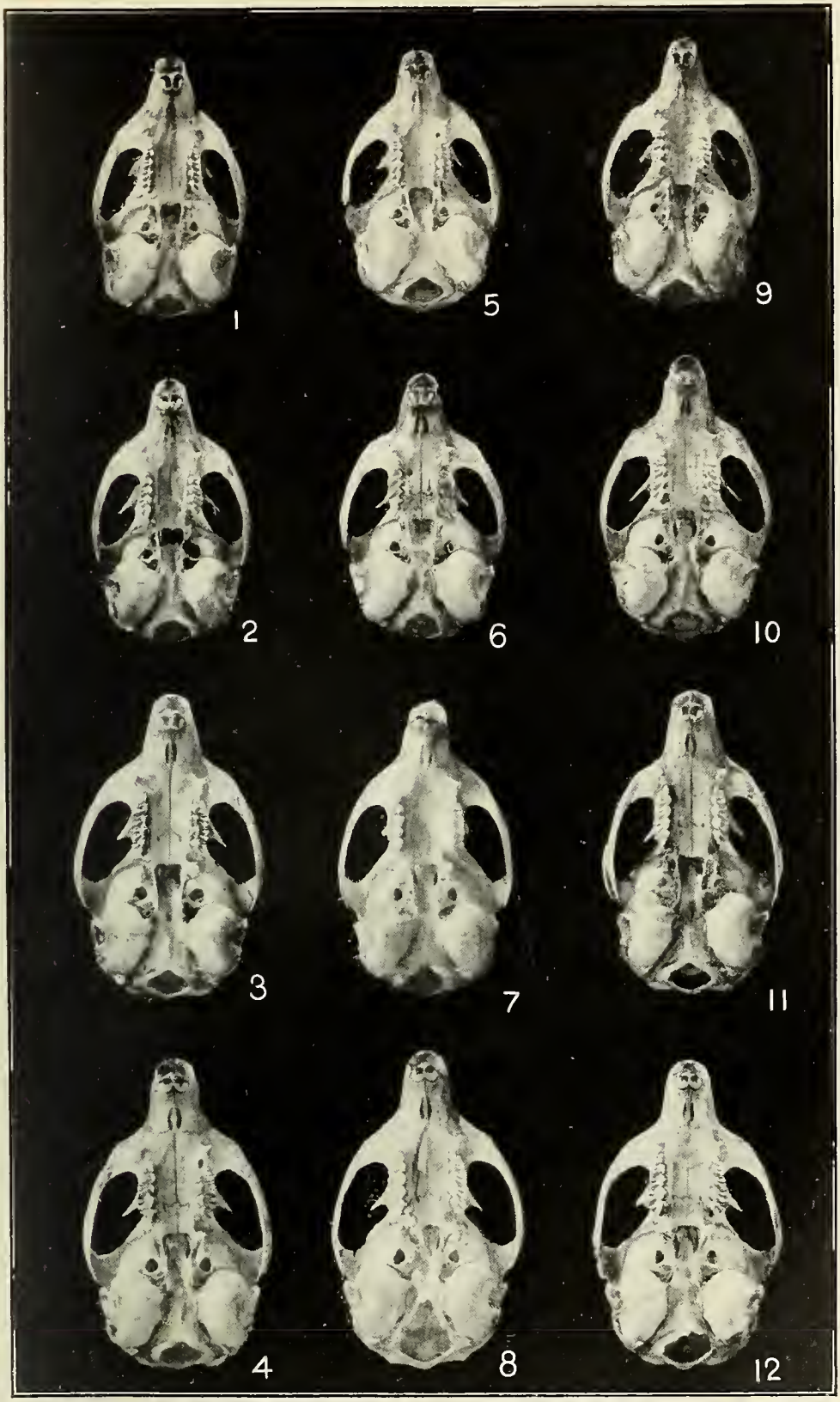
Fig. 8. *Glaucomys sabrinus yukonensis*, ♀ ad. (type), Camp Davidson, Alaska (No. 35320, U. S. Nat. Mus.).

Fig. 9. *Glaucomys volans querceti*, ♀ ad. (type), Citronelle, Fla. (No. 2451, Mus. Comp. Zool.).

Fig. 10. *Glaucomys sabrinus macrotis*, ♀ ad. (type), Catskill Mountains, N. Y. (No. 83152, U. S. Nat. Mus.).

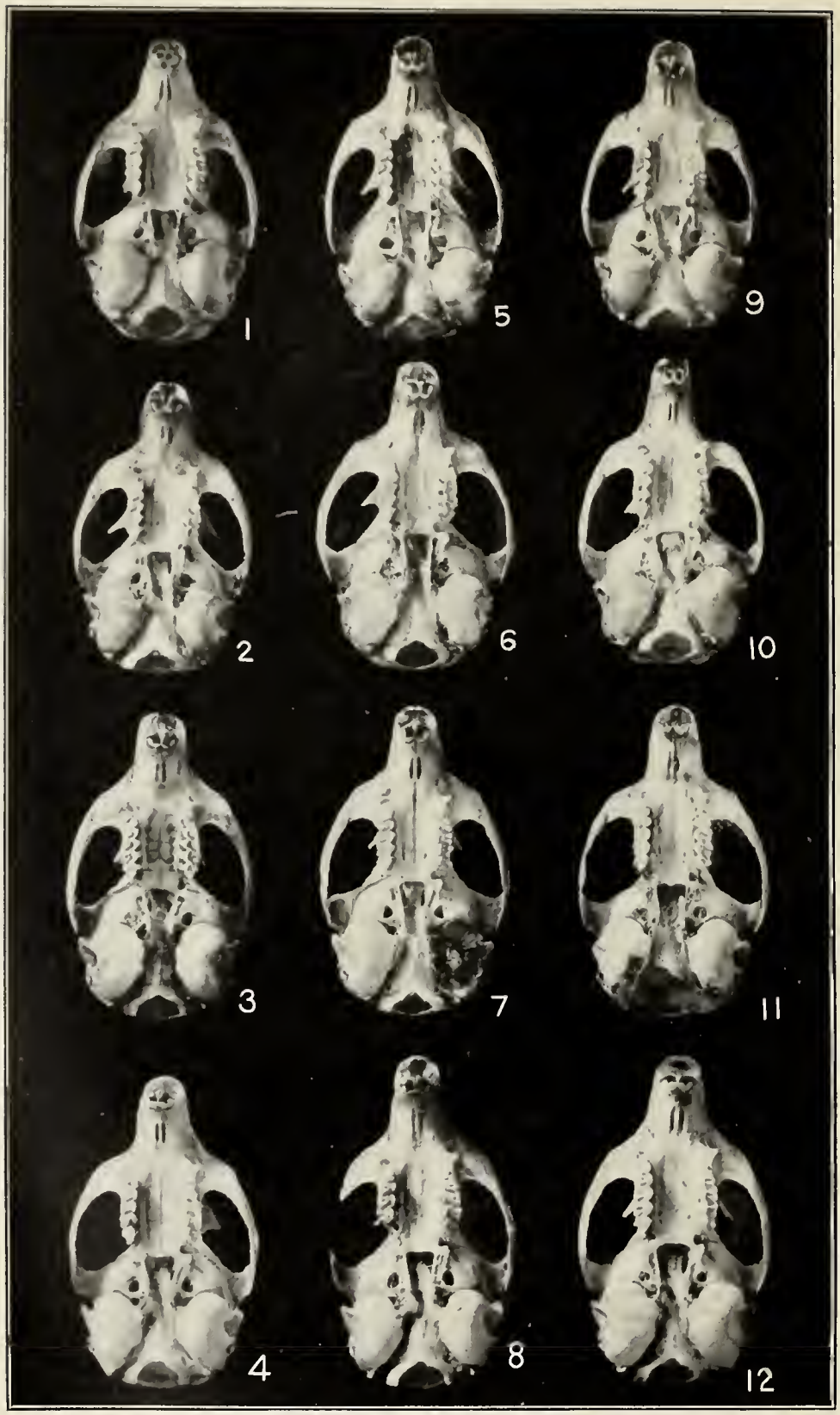
Fig. 11. *Glaucomys sabrinus sabrinus*, ♂ subad., Cochrane, Ontario (Carnegie Mus., not numbered).

Fig. 12. *Glaucomys sabrinus makkovikensis*, ad., Makkovik, Labrador (No. 13449, Mus. Comp. Zool.).



SKULLS OF GLAUCOMYS VOLANS AND G. SABRINUS.

1. G. v. saturatus.
2. G. v. volans.
3. G. s. bangsi.
4. G. s. alpinus.
5. G. v. texensis.
6. G. v. goldmani.
7. G. s. canescens.
8. G. s. yukonensis.
9. G. v. querceti.
10. G. s. macrotis.
11. G. s. sabrinus.
12. G. s. makkovikensis.



SKULLS OF GLAUCOMYS SABRINUS.

1. G. s. stephensi.
2. G. s. flaviventris.
3. G. s. klamathensis.
4. G. s. fuliginosus.
5. G. s. lascivus.
6. G. s. zaphæus.
7. G. s. columbiensis.
8. G. s. latipes.
9. G. s. californicus.
10. G. s. olympicus.
11. G. s. oregonensis.
12. G. s. bullatus.

PLATE V.

Fig. 1. *Glaucomys sabrinus stephensi*, ♂ ad., Laytonville, Cal., (No. 331, Cal. Acad. Sci.).

Fig. 2. *Glaucomys sabrinus flaviventris*, ♂ ad. (type), Bear Creek, Trinity County, Cal. (No. 13319, Mus. Vert. Zool.).

Fig. 3. *Glaucomys sabrinus klamathensis*, ♀ ad. (type), Fort Klamath, Oreg. (No. 87310, U. S. Nat. Mus., Biological Survey collection).

Fig. 4. *Glaucomys sabrinus fuliginosus*, ♀ ad., Easton, Wash. (No. 116864, U. S. Nat. Mus., Biological Survey collection).

Fig. 5. *Glaucomys sabrinus lascivus*, ♀ ad., Cisco, Cal. (No. 19495, Mus. Vert. Zool.).

Fig. 6. *Glaucomys sabrinus zaphæus*, ♀ ad. (type), Helm Bay, Alaska (No. 136137, U. S. Nat. Mus., Biological Survey collection).

Fig. 7. *Glaucomys sabrinus columbiensis*, ♀ ad., Penticton, B. C. (No. 1026, Victoria Mem. Mus.).

Fig. 8. *Glaucomys sabrinus latipes*, ♀ ad. (type), Glacier, B. C. (No. 68573, U. S. Nat. Mus., Biological Survey collection).

Fig. 9. *Glaucomys sabrinus californicus*, ♀ ad. (type), San Bernardino Mountains, Cal. (No. 10487, Acad. Nat. Sci. Philadelphia).

Fig. 10. *Glaucomys sabrinus olympicus*, ♂ subad., Olympic Mountains, Wash. (No. 5905, Field Mus. Nat. Hist.).

Fig. 11. *Glaucomys sabrinus oregonensis*, ad. (type), Columbia River, Oreg. (No. 253, Acad. Nat. Sci. Philadelphia).

Fig. 12. *Glaucomys sabrinus bullatus*, ♂ ad., Ketchum, Idaho (No. 8499, Mus. Comp. Zool.).

14520°—18—No. 44——5

PLATE VI.

Fig. 1. *Glaucomys volans volans*, ♀ ad., Cleveland Park, D. C. (No. 155517, U. S. Nat. Mus.).

Fig. 2. *Glaucomys volans querceli*, ♀ ad. (type), Citronelle, Fla. (No. 2451, Mus. Comp. Zool.).

Fig. 3. *Glaucomys volans saturatus*, ♂ ad., Dothan, Ala. (No. 178363, U. S. Nat. Mus., Biological Survey collection).

Fig. 4. *Glaucomys volans lœcensis*, ♀ ad., Sour Lake, Tex. (No. 136402, U. S. Nat. Mus., Biological Survey collection).

Fig. 5. *Glaucomys sabrinus macrotis*, ♀ ad. (type), Catskill Mountains, N. Y. (No. 83152, U. S. Nat. Mus.).

Fig. 6. *Glaucomys sabrinus sabrinus*, ♂ subad., Cochrane, Ontario (Carnegie Museum, not numbered).

Fig. 7. *Glaucomys sabrinus columbiensis*, ♀ ad., Penticton, B. C. (No. 1026, Victoria Mem. Mus.).

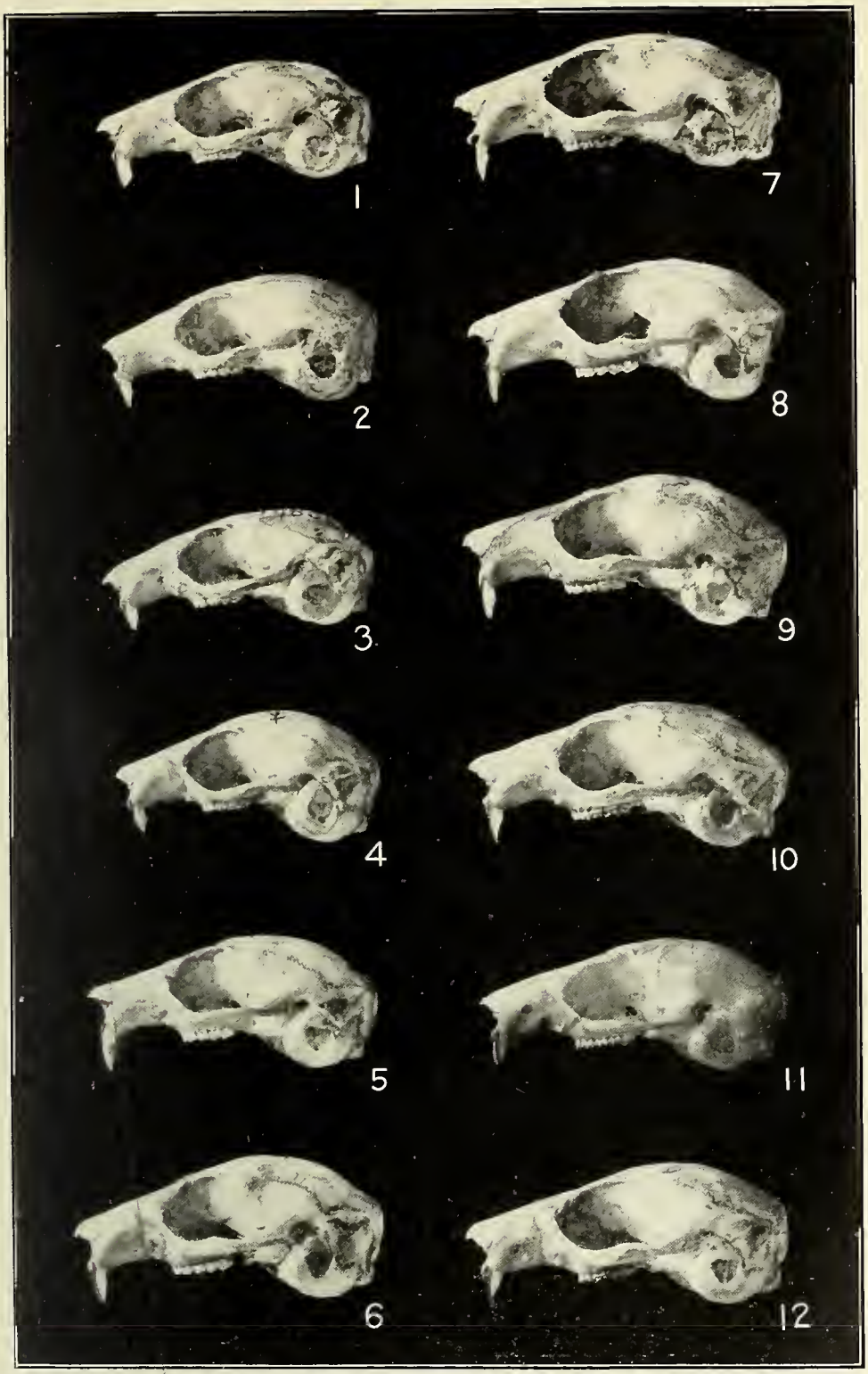
Fig. 8. *Glaucomys sabrinus oregonensis*, adult (type), Columbia River, Oreg. (No. 253. Acad. Nat. Sci. Philadelphia).

Fig. 9. *Glaucomys sabrinus zaphœus*, ♀ ad. (type), Helm Bay, Alaska (No. 136137, U. S. Nat. Mus., Biological Survey collection).

Fig. 10. *Glaucomys sabrinus bangsi*, ad., Florence, Mont. (No 168243, U. S. Nat. Mus., Biological Survey collection).

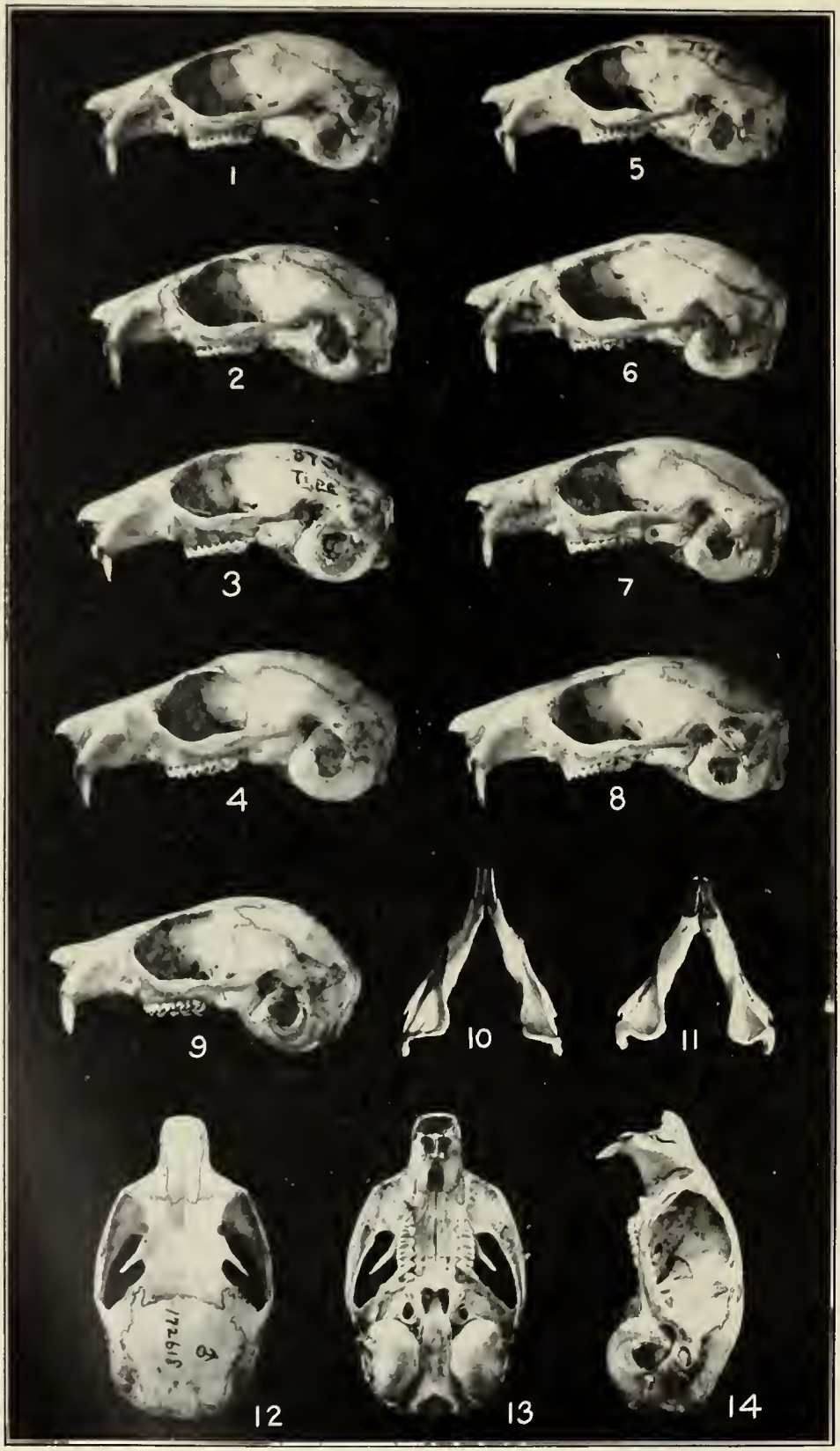
Fig. 11. *Glaucomys sabrinus canescens*, ♀ ad. (type), Portage la Prairie, Manitoba (No. 7663, Field Mus. Nat. Hist.).

Fig. 12. *Glaucomys sabrinus alpinus*, ♀ ad., Henry House, Alberta (No. 174398, U. S. Nat. Mus.).



SKULLS OF GLAUCOMYS VOLANS AND G. SABRINUS.

1. G. v. volans.
2. G. v. querceti.
3. G. v. saturatus.
4. G. v. texensis.
5. G. s. macrotis.
6. G. s. sabrinus.
7. G. s. columbiensis.
8. G. s. oregonensis.
9. G. s. zaphæus.
10. G. s. bangsi.
11. G. s. canescens.
12. G. s. alpinus.



SKULLS OF GLAUCOMYS SABRINUS AND PTEROMYS BÜCHNERI.

1. G. s. lascivus.
2. G. s. flaviventris.
3. G. s. klamathensis.
4. G. s. bullatus.
5. G. s. californicus.
6. G. s. olympicus.
7. G. s. fuliginosus.
8. G. s. latipes.
9. G. s. stephensi.
10. G. s. sabrinus.
11, 12, 13, 14. P. büchneri.

PLATE VII.

Fig. 1. *Glaucomys sabrinus lascivus*, ♀ ad., Cisco, Cal. (No. 19495, Mus. Vert. Zool.).

Fig. 2. *Glaucomys sabrinus flaviventris*, ♂ ad. (type), Bear Creek, Trinity County, Cal. (No. 13319, Mus. Vert. Zool.).

Fig. 3. *Glaucomys sabrinus klamathensis*, ♀ ad. (type), Fort Klamath, Oreg. (No. 87310, U. S. Nat. Mus., Biological Survey collection).

Fig. 4. *Glaucomys sabrinus bullatus*, ♂ ad., Ketchum, Idaho (No. 8499, Mus. Comp. Zool.).

Fig. 5. *Glaucomys sabrinus californicus*, ♀ ad. (type), San Bernardino Mountains, Cal. (No. 10487, Acad. Nat. Sci. Philadelphia).

Fig. 6. *Glaucomys sabrinus olympicus*, ♂ subad., Olympic Mountains, Wash. (No. 5905, Field Mus. Nat. Hist.).

Fig. 7. *Glaucomys sabrinus fuliginosus*, ♂ ad., Easton, Wash. (No. 116864, U. S. Nat. Mus., Biological Survey collection).

Fig. 8. *Glaucomys sabrinus latipes*, ♀ ad. (type), Glacier, B. C. (No. 68573, U. S. Nat. Mus., Biological Survey collection).

Fig. 9. *Glaucomys sabrinus stephensi*, ♂ ad., Laytonville, Cal. (No. 331, Cal. Acad. Sci.).

Fig. 10. *Glaucomys sabrinus sabrinus*, ♂ subad., Cochrane, Ontario (Carnegie Mus., not numbered).

Figs. 11, 12, 13, 14. *Pteromys büchneri*, ♂ ad., Shansi Mountains, China (No. 172618, U. S. Nat. Mus.).

INDEX.

[Synonyms in *italics*.]

A.

alpinus, Glaucomys, 40.
Pteromys, 40.
Sciuropterus, 40.
americana, Pteromys, 19.
americanus, Sciuropterus, 19.

B.

bangsi, Glaucomys, 38.
Sciuropterus, 38.
Breeding, 8.
büchneri, Pteromys, 15 (footnote).
bullatus, Glaucomys, 51.

C.

californicus, Glaucomys, 56.
Sciuropterus, 56.
canadensis, Pteromys, 31.
canescens, Glaucomys, 37.
Characters, generic, 14.
columbiensis, Glaucomys, 45.
cucullatus, Pteromys, 19.

E.

Economic status, 10.

F.

flaviventris, Glaucomys, 54.
Food, 9.
fuliginosus, Glaucomys, 47.
Sciuropterus, 47.

G.

Generic names, 12.
Glaucomys, genus, 11.
cranial measurements, tables, 59.
generic characters, 14.
history, 12.
key to species, 16.
list of species, 16.
nomenclature, 12.
specific names, 13.
Glaucomys alpinus, 40.
bangsi, 38.
bullatus, 51.
californicus, 56.
canescens, 37.
columbiensis, 45.
flaviventris, 54.
fuliginosus, 47.
goldmani, 28.
klamathensis, 52.
lascivus, 55.
latipes, 48.
Glaucomys macrotis, 35.
makkovikensis, 34.
olympicus, 49.
oregonensis, 44.
querceti, 26.
sabrinus, 31.
saturatus, 24.
stephensi, 57.
texensis, 27.
volans, 19.
yukonensis, 41.
zaphæus, 43.
goldmani, Glaucomys, 28.
Sciuropterus, 28.

H.

Habits, 5.
History, 12.
hudsonius, Pteromys, 32.
Sciuropterus, 32, 35.
Sciurus, 31.

K.

Key to species, 16.
klamathensis, Glaucomys, 52.
Sciuropterus, 52.

L.

lascivus, Glaucomys, 55.
Sciuropterus, 55.
latipes, Glaucomys, 48.
List of species, 16.

M.

macrotis, Glaucomys, 35.
Sciuropterus, 35.
makkovikensis, Glaucomys, 34.
Sciuropterus, 34.
Material examined, 11.
Measurements, cranial, explanation of, 11.
tables of, 59.
Molt, 10, 21.
Mus, genus, 11.
volans, 19.

N.

nebrascensis, Pteromys, 20.
Nests, 7.
Nomenclature, 12.

O.

olympicus, Glaucomys, 49.
Sciuropterus, 49.

oregonensis, Glaucomys, 44.
Pteromys, 44.
Sciuropterus, 44.

P.

Pelage, 10.
petaurista, Sciurus, 12.
Pteromys, generic characters, 15.
bilchneri, 15 (footnote).
volans, 15 (footnote).
Pteromys, genus, 11.
Pteromys alpinus, 40.
americana, 19.
canadensis, 31.
cucullatus, 19.
hudsonius, 32.
nebrascensis, 20.
oregonensis, 44.
sabrinus, 32.
virginianus, 19.
volucella, 19.

Q.

querceti, Glaucomys, 26.
Sciuropterus, 26.

S.

sabrinus, Glaucomys, 31.
Pteromys, 32.
Sciuropterus, 32.
Sciurus, 31.
saturatus, Glaucomys, 24.
Sciuropterus, genus, 11.
Sciuropterus alpinus, 40.
americanus, 19.
bangsi, 38.
californicus, 56.
fuliginosus, 47.
goldmani, 28.
hudsonius, 32, 35.
klamathensis, 52.
lascivus, 55.
macrotis, 35.
makkovikensis, 34.
olympicus, 49.
Sciuropterus oregonensis, 44.
querceti, 26.
sabrinus, 32.
silus, 20.
stephensi, 57.
volans, 20.
volucella, 19.
yukonensis, 41.
zaphæus, 43.
Sciurus, genus, 11.
Sciurus hudsonius, 31.
sabrinus, 31.
petaurista, 12.
volans, 12, 13.
volucella, 19.
silus, Sciuropterus, 20.
Specific names, 13.
stephensi, Glaucomys, 57.
Sciuropterus, 57.

T.

texensis, Glaucomys, 27.

V.

virginianus, Pteromys, 19.
Voice, 6.
volans, Glaucomys, 19.
Mus, 19.
Pteromys, 15 (footnote).
Sciuropterus, 20.
Sciurus, 12, 13.
volucella, Pteromys, 19.
Sciuropterus, 19.
Sciurus, 19.

Y.

yukonensis, Glaucomys, 41.
Sciuropterus, 41.

Z.

zaphæus, Glaucomys, 43.
Sciuropterus, 43.

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